AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION

VOLUME 24 NEW YORK AND LONDON NUMBER 5

Published at 218 William St., New York,
Every Thursday by the

American Machinist Press.

[INCORPORATED.]

Also published at 34 Norfolk St., Strand, London, W. C.,
Every Saturday.

Correspondence on mechanical subjects solicited. Name and address must always be given—not necessarily for publication.

Address all business communications to the American Machinist Press. Matter for reading columns may be addressed to the Editor.

Subscribers can have address changed at will. Give old and new addresses. Date on wrapper denotes end of month in which subscription expires.

Subscription Price:

$4 per year, postage prepaid, to any post office in the world. No back numbers beyond current year.
For sale by newsdealers, generally.

Subscription agent for Denmark, Norway and Sweden, V. Lowener, Copenhagen. Subscription agent for Germany, Austria and Holland, Gustav Diechmann & Sohn, Neue Promenade 4, Berlin Subscription agent for Spain, J F. Villalta, Puertaferrisa, 7-9 Barcelona.

Entered at New York P. O. as mail matter of the second class.

Cable address, "MACHINIST," N. Y.
Lieber's and A B C Codes.

An Index for All.

Numbers of our readers, in asking for the index to the volume for 1900, take the trouble to explain that they buy the paper regularly at the newsstands, and ask the index sent as a favor. We repeat that an index will be sent to *anyone* who sends us his address on a postal card, or otherwise, and says "Kindly send index for 1900."

Modern Methods in Teaching Languages and Mathematics.

In our issue No. 47 of last year, in an article entitled "Practical Mathematics," we devoted some space to the new method of teaching mathematics as an art rather than as a science, of which Professor Perry, of the English Royal College of Science at South Kensington, is the chief exponent.

That article excited a quite unusual degree of interest among our readers. Request after request for the names of the publishers of Prof. Perry's latest pamphlet was sent to us—a fact which shows the widespread interest in the general subject.

It seems to us that a close parallel can be drawn between the change in method introduced by Prof. Perry into the teaching of mathemtics and the change which during the past quarter century has come over the teaching of modern languages in all progressive schools. Former students who are now in middle life will not need to be reminded of the profitless months of work which were devoted to the study of the entire grammar of a foreign language and of the manner in which this was followed by the almost equally profitless translation of classical literary works in those languages, to the almost entire exclusion of the constructive use of the language by the student. The aim was first to give the student an exact knowledge of the structure of the language in order that he might be able to do some useless "parsing," and then to enable him, with the aid of a dictionary, to be able to translate good French or German into bad English. The fact that everyone learns his mother-tongue without reference to its grammar, and that an adult can acquire a fair command of a foreign language, sufficient for ordinary purposes, with but slight knowledge of its grammar, was ignored. Instead of giving the student the limited vocabulary and simple grammatical constructions which form the basis of all ordinary conversation in all languages, and on this building a working knowledge of the language, he was given a vocabulary which was selected with little regard to its real use, and was put to the study of the niceties of construction of literary works. In other words, the study was directed toward the scientific analysis of the language and not toward its use as an art.

The methods that still prevail in the study of mathematics form a close parallel to these old and now discredited methods in the study of languages. The separating of the subject into water-tight compartments, so to speak, each to be entered only after the previous one has been thoroughly explored, with the complete ignoring of the fact that the subject is really one organic whole, is fairly comparable to the study of each of the parts of speech in succession, while the solution of set and ideal problems, as far as possible removed in kind from those with which the engineer has to deal, is comparable to the translation of such exercises as "Will your grandmother wear her red apron to-day? No, but she will eat green turtle frappé for dinner."

As the study of languages has been modernized to the great advantage of the student in obtaining a much better working knowledge of them with great economy of time, so, we believe, will the study of mathematics be modernized with equal economy of time and equally valuable results.

Vacations for Government Workmen.

Congress has recently passed, by a unanimous vote, a bill authorizing a vacation for fifteen days each year for all employees in Government navy yards, gun factories, arsenals and naval stations. The Naval Committee had stricken out the arsenals as not strictly under the Navy Department or a part of it, but they were finally included. In the discussion of this point a number said that it was manifestly unfair to give clerks in the executive departments in Washington practically sixty days' leave and deny to a class of employees whose work was of the highest importance in its delicacy and value to the government a leave of fifteen days. He further said that if letter carriers and government clerks were entitled to thirty days off, certainly the workmen in the arsenals, many of them men of the rarest attainments in knowledge of the art of gun construction, were worthy of this short vacation. It needs not to be said that we are heartily glad of the good fortune of these men. The measure is a good one and the example of it is good. We would be glad to see every worker everywhere who toils hard and faithfully for fifty weeks of the year have his two weeks solid for recreation. And there is no good reason why they should not have as much time for recuperation as is given any other class of government employees.

Specifications for a Steam Plant.

A Western friend sends us some model (?) specifications for a steam plant intended for an electric railway. Some of the requirements are so unusual that they deserve to be published as guides to other engineers engaged in this line of work, and we give them below:

"The Engine to be of the type of what is known as the Tandem or cross Compound, with high pressure cylinder 20" and low pressure 36" in Diameter, and 18" stroke, with 220 revolutions per minute, or its equivalent.

"The Engine to be self-contained, with sub-base, in pair, on one frame, coupled together with the piston rods working on one crank shaft, each Engine being of equal capacity with the other, or both on one piston rod.

"The Engine to be provided with drop sight oil cups on its working parts, and in the steam feed pipe and with self-feeding candle grease lubricators on the bearings.

"With the Engine is to be provided a

circulating condenser, complete with Hot well vaccuum, and a water circulating pump of size to correspond with the exhaust outlet of the Engine, also an oil or grease separator, or extractor to prevent the oil or grease from entering the condenser, to be of type known as the Cochran separator for vaccuum of condensing system.

"The evaporation capacity of the Boilers to be equal at least to ½ pounds of water, per pound of coal burnt per hour, with easy steaming, natural draught and ordinary firing, using good average Illinois Bituminous Coal, with fairly clean grates and fire surfaces."

Referring to the first quoted paragraph, we may say that other paragraphs, in which the arrangement of the belt pulleys is described, show that the writer supposed the tandem and cross-compound types of engine to be the same.

The "hot well vaccuum" as an article of commerce may, we think, be fairly looked upon as something new under the sun.

A most sensible, practical and highly commendable movement is gaining strength and impetus among the labor unions. At Toledo it is reported that the ore handlers and longshoremen have entered into an agreement with the operators on the docks along Lake Erie ports that no intoxicants shall be used by the men during working hours. This means, of course, the saving of thousands of dollars to the men, and no one believes that they will be physically the worse for it. William A. Perrine, speaking for the iron molders, says that there is less beer drinking during working hours than formerly. Those who may find nothing to approve or admire in total abstinence may still heartily endorse the idea of business in business hours.

The "Prinzessin Victoria-Luise."

The American general manager of the Hamburg-American Line, Mr. Emil L. Boas, entertained a number of his friends on board the new Hamburg-American Company's cruising yacht, the "Prinzessin Victoria-Luise," at luncheon on January 23, on which occasion a representative of this paper had an opportunity of seeing something of what the new vessel is like and of testing the quality of its most excellent cuisine.

It is doubtful if any other passenger vessel has entered the port of New York equal to this one in luxury, comfort and adornment. The new vessel has the lines of a yacht, though she is intended for cruising in all waters and in all weathers and is intended primarily for comfort. She is to be used in carrying parties to the Mediterranean, the West Indies, or wherever parties may be made up to go upon pleasure trips. Though not a large vessel she is of unusual size for her type, being 450 feet long over all, 47 feet beam and 30 feet depth. She is not intended to carry mail or cargo of any kind, but only passengers, their baggage and supplies. The number of passengers carried is to be limited to the seating capacity of the main dining room, which can accommodate about 220 persons. She is of 6,000 tons capacity, twin screw, with a total horse-power in the main engines of 4,200. The engines are of the four-cylinder, quadruple-expansion type, the cylinders being 484, 700, 1,000 and 1,450 millimeters diameter and 920 millimeters stroke. The engines run at 120 revolutions at a pressure of 213 pounds at the boiler and the vessel is rated at 15 knots speed.

The writer had a very pleasant interview with John Edelmann, the chief engineer, during which he said that, notwithstanding the uncommonly rough weather encountered on the voyage over no stoppage or slowing of the engines was necessary, and no trouble of any kind was experienced with them.

Kaiser Wilhelm has taken a special interest in this vessel, having suggested some features of her construction which are said to be based upon his experience with his own Imperial yacht. Soon after she was placed in commission he spent thirty-six hours aboard of her and the officers of the vessel pronounce him to be what we are in the habit of calling a "good fellow." The chief engineer exhibits with pardonable pride a pair of link cuff buttons which the Emperor gave him as a souvenir of his visit. These link buttons are very magnificent ones, with a design of a crown on each button worked out in diamonds and rubies. At the same time he bestowed upon Captain Sauermann the order of the Prussian Crown, of which, of course, the captain is very proud. In speaking of his visit the captain said: "You have to be well prepared when the Emperor visits a vessel on which you may hold an official position. He asks a lot of questions and he expects them to be answered. For instance, he said to me, 'Captain, what is the diameter of your propellers?' and of course I had to tell him. Having had some experience with him on previous visits to other vessels, I was expecting such questions and had prepared a long list of them so as to be ready to answer almost anything he might ask me."

This goes to show that the Emperor's reputation of taking a great interest in matters of marine architecture, etc., is being well sustained and that he is disposed to take every occasion to show those engaged in shipping that he is interested and anxious to promote shipping interests in every possible way.

Among other unique features of the new vessel, which is named for the Kaiser's daughter, there is a full-fledged gymnasium aboard with all sorts of exercising and massage machines, many of them driven by power. For instance, one may vault into a saddle and by moving a belt shifter start the machine which gives the saddle a motion calculated to make one think he might be taking his morning horse-back ride through the Thier Garten. There is also a dark room for amateur photographers' use.

Our Commercial Record for 1900.

Details covering the minutiæ of our commercial relations with the other commercial countries of the world for the past year are not yet available, but the figures covering that work as an entirety are more satisfactory than are those for any corresponding twelve months in our history. The imports for the year show a total value of $829,052,116, or $30,084,706 more than those for 1899. These imports were divided as follows: Merchandise imported free of duty, $342,294,624, as against $350,897,220 in 1899, or a decrease of $8,602,593. There was an increase in those of goods subject to duty from $448,070,190 in 1899 to $486,757,489, or of $38,687,299 for the year 1900.

Our exports of merchandise of domestic origin during the year were valued at $1,453,113,110, or $200,180,766 more than those for 1899; while $24,937,744, or an increase of $2,402,117 over those for the preceding year, stands to the credit of our exports of foreign origin. This gives a total export value for 1900 of $1,478,050,854 as against $1,275,467,971 in 1899, or a total increase of $202,582,883; thus leaving a balance of trade in our favor for the year amounting to $172,498,177. A favorable feature of the increase in our foreign trade is that it has been a gradual one, year by year for the past five years, as will be seen by comparing the total export values as follows:

1896	$1,005,837,241
1897	1,099,709,045
1898	1,225,546,266
1899	1,275,467,971
1900	1,478,050,854

A. F. Tennille.

Commercial Review.

New York, Saturday, Jan. 26, 1901.

TOOL MARKET FEATURES AND MISCELLANEOUS NOTES.

It must be admitted that December prophecies, which seemed justified at that time by inquiry and orders received, have not been fulfilled in January. A record of the market as it is now must be written in a vein of some disappointment which may give the impression that things are worse than they really are, and for this allowance must be made. Trade is rather slow as regards orders closed and while a fair-to-good inquiry continues there is some indication that this is not what it was. Dealers are scanning the Western horizon like weather prognosticators and some of them think they see dark clouds hovering over Cincinnati. Short hours,

heaped-up stocks and a resultant demoralization of prices are the stories variously told. It is rumored that a 15-inch shaper can be obtained in the West as low as $150, but our informant was not sure whether the domestic or export price was referred to. It seems to be a fact that to a pretty general extent prices have quietly been getting easier for several months past. One party who is in close touch with affairs states that he could replace his present stock cheaper than it cost him, and he admits that the tendency of manufacturers to accept concessions seems to have been greater since the first of the year. As to this, opinions differ. It is particularly in the line of lathes that there is an overstock, according to one report from the West and a break in prices of them is thought to be incipient. As a partial offset to this, we may quote a statement that one of the leading Cincinnati builders, a concern which makes a specialty of lathes, is supplied with plenty of work and has comparatively little stock on hand either at home or consigned to dealers.

Whatever may be the condition among manufacturers, there seems to be a determined effort on the part of sales concerns to work off stocks, and it is intimated that in one case at least this has been done with the sacrifice of profits, if not with a net deficit. A lot of planers, for instance, are said to have been sold by one dealer to another at less than the trade price of the manufacturer. From bargain-counter sales by dealers there may be drawn, however, an inference not altogether unfavorable. These may indicate that more business is being done in the country than manufacturers' order books show, only that it is being diverted in this way, so that they are not getting the benefit of it for the time being.

The British Westinghouse Company's prospective machine-tool orders are growing in estimated magnitude. A few weeks ago $500,000 was regarded as the approximate amount of the purchases, but yesterday a guess of $1,000,000 was heard on the street. Some $50,000 will be spent on power presses, it is said, and there will be punches and shears galore.

The Rock Island arsenal contracts were still unawarded so far as known yesterday by one of the concerns most largely interested.

A machine-shop equipment has been ordered by the Tietjen & Lang Dry Dock Company, Hoboken, N. J. The concern has hitherto been having its machine work done at a neighboring shop, but is now fitting up one of its own. The tools include lathes, drillls, etc., and will be furnished by the Garvin Machine Company.

There is something rumored in the market about good recent transactions in railroad tools. Railroads are indeed a strong feature of the tool market just now. They have made large profits and are willing to undertake the expense of new shop equipment.

Recent information from Berlin confirms the continued industrial depression in Germany. Exports thence are at a low ebb, partly on account of the South African War, and the tendency at home is to curtail buying. The satisfaction of buyers' wants does not account for all the shrinkage of transactions in tools by which the domestic manufacturers as well as those in America are affected. German consumers are not placing orders even up to their actual requirements.

One substantial plum which we may announce as ripe for tool builders is the equipment of a 200x125 foot machine shop extension of the Dodge Manufacturing Company, Mishawaka, Indiana. A new foundry building of the same size will also be put up. They will each be of steel construction, with gravel roof and side walls of brick and provided with 35-ton electric traveling cranes, together with the necessary heating apparatus and sprinkler equipment. A new 72-inch cupola will be installed in the foundry and the electrical equipment of the plant increased by the addition of a 150-kilowatt generator and engine. It is also proposed to increase the main driving power by the addition of a 28x48-inch Corliss engine. Bids for the construction and equipment are now being considered.

The Buffalo Forge Company recently placed on the market a folding forge, which packs into a case 22½ by 27½ by 10 inches. They call it the Buffalo Army and Navy forge. It is in use in the Imperial Japanese Navy. The company lately received a rush order for 100 of these forges for use by the United States Army in the Philippines. The forges were completed and placed on the transport in three days.

A notable contract has been placed by the Chambley Manufacturing Company with the Westinghouse Electric & Manufacturing Company. It calls for 20 transformers aggregating 72,000 horse-power (3,600 horse-power each), which is believed to exceed every transformer order before placed. These transformers are of the Westinghouse air-blast type. Each weighs approximately eleven tons and stands nine feet high. Ten of them are used to raise the voltage from 2,200 to 25,000 volts at 8,000 alternations. The input is two-phase and the output three-phase. The remaining ten transformers for lowering the voltage receive the three-phase line current at 22,000 volts and deliver out a two-phase current at 2,400 or 4,800 volts as required. The blowers for cooling both the raising and lowering transformers are operated by Westinghouse type C induction motors. The efficiency of these transformers is considerably over 98 per cent.

A number of machine and small tools are required for the equipment of a machine shop and forge room of a manual training school. E. V. Lallier, instructor in metal work at the Hebrew Technical Institute, 36 Stuyvesant street, New York, desires catalogs to this end.

A plant is to be established for the manufacture of a railroad-track moving or throwing device invented by David C. Creese, of New Brighton, Pa., beside other railway equipment and mining supplies. A company called the National Equipment and Supply Company has been organized at Pittsburgh with $50,000 capital authorized. A location is being sought for the plant, the details of which are with the manager, Thomas J. Burke, 516 Wood street, Pittsburgh.

An office has been opened at 15 Cortlandt street, New York, by the American Machinery and Export Company, which was recently incorporated under New Jersey laws with $250,000 capital. The company will deal in machinery of all kinds, chiefly for export and its specialty will be purchases for foreign railroads. The vice-president and general manager is Wesley Meeteer, for some time purchasing agent of the Jackson & Sharp Company, Wilmington, Del.

The Cleveland Punch and Shear Works Company put a new battery of boilers in operation January 17 and will soon have its new engine installed and running. With modern electrical equipment throughout the shops, it expects to have one of the most complete plants in the country for the production of heavy tools.

The stockholders of the Detroit (Mich.) Twist Drill Company have voted to increase the capital stock from $30,000 to $80,000. The business of the company has increased very much during the past few years, and the directors say that the year just closed was particularly satisfactory.

The E. P. Allis Company's Spokane (Wash.) branch has closed a $40,000 contract with the British Columbia Copper Mining Company for the equipment of the first converting plant in the province, which will be installed at the Greenwood smelter. A 40-ton electric crane and a blowing engine constitute part of the machinery.

The Cramp Ontario Steel Company, Ltd., capitalized at $5,000,000, is about to establish blast furnaces, an open hearth steel plant and rolling mills at Collingwood, Ont. Charles D. Cramp is quoted as stating that with the vast resources of rich ore found in Ontario there is no reason why the province should not experience a development of the steel industry like that which has taken place during the last fifteen years in the United States.

The American Pneumatic Tool Company, whose factory is at 844 Washington street, New York, and which is one of the pioneers in its line, has lately undergone a revolution in management. This company was organized a dozen years ago and made an air drill, but notwithstanding the popularity attained by the tools it manufactured it has failed to be remunerative to its stockholders and civil

war has been waged for eight years. Hitherto the administration party has maintained itself in power, but finally the opposition has won by a small plurality and a new board of directors has been put in which has elected C. E. Danforth, Jr., president. It is the intention to carry out a forward business policy. The company may soon rise to a new prominence among its younger competitors.

CHICAGO MACHINERY MARKET.

In some lines of the machine supply trade the closing of the month shows a decided change for the better from the first half. There has been good business all the month for fittings, such as shafting, belting, pulleys, etc. Many shops were idle during the earlier part of the month and a few have not yet lighted fires, but the idleness was made the common occasion for repair work. Entire shops have been overhauled and some fittings that might possibly have lasted a bit longer but were at best short lived, were removed forever. To such an extent does this reburnishing of facilities seem to have been carried that some supply houses have been making new records for the month. But for material and for supplies used in actual operations the briskness of trade has not been so uniformly flattering, though even here trade during the closing days of the month has developed unusual activity.

And the common consensus of opinion is that steady improvement is to be looked for, barring the unexpected. The shops alluded to have not only put themselves in order but have been buying heavier machinery, so that with the re-starting of activities consumption will be on a larger scale than ever. A traveling salesman, who visits stove factories and machine shops, says that on his last trip through Iowa he made twenty-seven calls and found eighteen, or two-thirds, of the plants idle, because of inventory, dull season or otherwise. Since then many have resumed. What impressed him was the general preparation for more active work.

The machine shop trade in Chicago is described by some supply men as relatively less active than in the country, but there is general admission of improved conditions. Prospects for the building of shops and residences were never better. Builders' hardware is accordingly in brisk demand and the toolmakers are visibly and beneficially affected.

The Armstrong Bros. Tool Company note a steady trade, with gratifying gains in some territory. The South has been buying lately more generously than before and the Pacific coast also is sending in some heavy orders. One large order this month was for the navy yard at League Island, Pa., the specifications embracing every size and variety of the company's manufacture.

C. H. Besly & Co. say trade is so uniformly good that specialization of activity is impossible. Their goods are going everywhere from Kamchatka to Patagonia. The Reeves Pulley Company reports that January sales at Chicago will probably exceed those of any previous month. A gratifying circumstance is that the business is composed of small orders almost exclusively.

CINCINNATI REPORT.

If there has been any special tendency to produce in the minds of manufacturers of machine tools, such as milling machines, drills and lathes hereabouts a feeling that the future holds encouragement it is seen in the marked increase in Southern business. From both the manufacturers of tools of the types named and machines for electric-generating service come reports of good sales and increasing inquiry from the South. A prominent official of a machine-tool concern that has been established since 1886 says that the business from that territory placed on their books in the last six months exceeds that of any similar period in the history of the house. For the past two or three months it has been generally conceded that Europe holds little prospect for encouragement to American manufacturers. An official who has made several trips to the other side and has just returned, in discussing the situation as he found it, says in his opinion trade in Germany and Russia is very dull. There is some business in Great Britain. On the whole he found very few dealers despondent, and the majority of them left the impression that the year should develop conditions which which would be eminently profitable to American concerns. All returned local manufacturers who spent several weeks visiting the trade centers, including a visit to the Paris Exposition, concur in the feeling that American manufacturers are fitted to compete successfully with Europeans in any branch of the business and in any market.

One is particularly impressed with the evidences of improving prospects among manufacturers of electrical machinery.

The Bullock Electric Manufacturing Company is running to its fullest capacity to get out orders on special types. The Bullock Company has just shipped to the United States Navy Yard at Brooklyn, for Dry Dock No. 3, three 450 horse-power and two 120 horse-power motors with switchboard, for use in the pumping department. The growing tendency among great concerns to do their own printing is productive of business for the manufacturers of electrical machinery. An additional order from the Prudential Life Insurance Company, at Newark, calls for some twenty motors to be installed in the printing department of that concern.

The Triumph Electric Company has sold for installation in the steamboat "Exporter," plying between St. Louis and New Orleans, a complete plant, consisting of a vertical engine with direct-connected generator. The same company has also sold, through their export agents, machinery for Merida, Mex., Mexico City and British Honduras. Several motors were also shipped to Foster & Webb at Nashville.

The E. A. Kinsey Company, jobbers, report business so far this year in excess of any similar period since the beginning of last.

A consensus of opinion from the manufacturers of heavier and special type of tools shows that the most important recent sales have been in the East and Middle West, with a sprinkling of medium grade throughout the South. The engine builders and electrical manufacturers seem to be the best patrons. Local concerns are in receipt of advice that the contracts for the British Westinghouse Company's new department will not be let for at least four weeks.

The Niles Tool Works, of Hamilton, has just installed a complete telephone plant in their factory.

Local manufacturers are discussing the future of the Compressed Air Company, an enterprise the product of which is expected to replace electricity as a motive power in the propelling of street cars. The compressed-air system is conceded a possibility as soon as the formalities which see the absorption of the Cincinnati Street Railway Company by the Elkins-Widener Company are closed. M. E. Ingalls, president of the Big Four Railroad, is president of the new company.

Quotations.

NEW YORK, Monday, Jan. 28.

Iron—American Pig, tidewater delivery:—

Pennsylvania Irons:	
No. 1 X foundry	$16 25 @ $17 00
No. 2 X foundry	15 50 @ 16 00
No. 2 plain	14 50 @ 15 25
Gray forge	14 00 @ 14 50
Alabama Irons:	
No. 1 foundry, or soft	15 25 @ 15 75
No. 2 foundry, or soft	14 50 @ 15 00
No. 3 foundry	13 75 @ 14 25
Foundry forge, or No. 4	13 25 @ 13 75

Bar Iron—Base sizes—Good standard brands from store, 1.75 @ 1.90c.; mill prices on dock, 1.50 @ 1.60c.

Tool Steel—Base sizes—Good standard quality, 7 @ 8c.; extra grades, 10 @ 14c.; special grades, 16c. upward.

Machinery Steel—Base sizes—From store, 1.70 @ 1.80c.

Cold Rolled Steel Shafting—Base sizes—From store, 2½ @ 2¾c.

Copper—Lake Superior ingot, 16⅞ @ 17c.; electrolytic, 16⅝c.; casting, 16½ @ 16⅝c. In some cases these prices could probably be shaded ⅛c. more.

Pig Tin—27c. for 5 and 10-ton lots, f. o. b.

Lead—For wholesale lots, 4⅜c., with .02½c. extra for carloads.

Spelter—4.00 @ 4.10c., New York.

Antimony—For 5-cask quantities Cookson's is about 10½c.; Hallett's, 9c., U. S., 9.00 @ 9.10c., and Japanese, 8¼c.

Leading Features of the Westinghouse-Parsons Steam Turbine.*

BY FRANCIS HODGKINSON.

The first Parsons steam turbine and generator was built in 1884. It developed 10 horse-power at 18,000 revolutions per minute. It ran for several years in Gateshead-on-Tyne, England, supplying current for the manufacture of incandescent lamps, and is now in the South Kensington Museum. It consisted of two groups of fifteen turbines each, the steam entering between them and passing in opposite directions through each *group*.

Fig. 1 is a general longitudinal section through a Westinghouse-Parsons steam turbine. The steam enters at the governor valve, arriving at the chamber *A*, and passes out to the right through the turbine blades, eventually arriving at the exhaust chamber *B*. The blades are shown in Fig. 7, the steam passing first a set of stationary blades and impinging on the first set of moving blades, driving them around, and so on. The areas of the passages increase progressively in volume, corresponding with the expansion of the steam. They will, however, be described more fully later. On the left of the steam inlet, Fig. 1, are shown revolving balance pistons *C*, *C*, *C*, one corresponding to each of the cylinders in the turbine, which, according to size, may be one, two, three or four in number. The steam at *A* presses against the turbine and goes through doing work. It also presses in the reverse direction, but cannot pass the piston *C*. At the same time the pressure, so far as the steam at *A* is concerned, is equal and opposite, so that the shaft is not subjected to any end thrust.

The pressure *D* is equal to that at *E* by reason of the balance port *F*. Consequently, so far as the steam pressure at *E* is concerned, there is no end thrust. This same fact also applies to *G*. The area of the balance pistons is so arranged that no matter what the load, the steam or the exhaust pressure may be, the correct balance is preserved and the shaft has no end thrust whatever.

* Extracted from a paper read before the Engineers' Society of Western Pennsylvania.

At *H* is shown a thrust bearing, which, however, has no thrust to take care of, but serves to maintain the correct adjustment of the balance pistons. The thrust bearing is in two halves, the lower half capable of adjustment in one direction, the upper half in the reverse.

The balance pistons never come in mechanical contact with the cylinder, and consequently there is no friction. The thrust bearing has ample surface, and besides is subjected to forced lubrication and does not wear. The adjustments once made always remain good. There is obviously some leakage past the pistons, but it is found to be very small. Centrifugal force seems to have something to do with keeping down this leakage. The particles endeavoring to escape have to pass radially inwards in going through the small clearance. It is supposed, then, that the rapidly revolving pistons have the effect of throwing outwards the particles with which they come in contact by reason of skin friction, so that the particles being slung outwards tend to oppose the escape of the particles inwards. This theory, however, is somewhat imaginary, but in view of the economy obtained, the leakage cannot be very great.

At *K* is a pipe connecting the back of the balance pistons at *L* with the exhaust chamber to ensure the pressure at this point being exactly the same as that of the exhaust.

At *J* are shown the bearings. They are also shown separately in Fig. 2 and are unique in construction. The bearing proper is a gun-metal sleeve, which is prevented from turning by a loose-fitting dowel. Outside of this are three concentric tubes having a small clearance between them. This clearance fills up with oil and permits a vibration of the inner shell, at the same time restraining the same. The shaft, therefore, revolves about its axis of gravity instead of its geometric axis, as would be the case were the bearing of everyday construction. The journal is thus permitted to run slightly eccentric, according as the shaft may be out of balance. This form of bearing in a very remarkable manner performs the functions of De Laval's slender flexible shaft. But in this case the shaft is built as rigidly as possible, and is not liable to crystallization, which would result in eventual rupture.

The bearings have ample surface, are continuously lubricated under pressure, and it has been found in practice that they do not wear. As may be seen in Fig. 2, the bearings are surrounded by an outer cast-iron sleeve, in which are fitted keys which may be shimmed up to permit any adjustment of the position of the shaft relative to the cylinder.

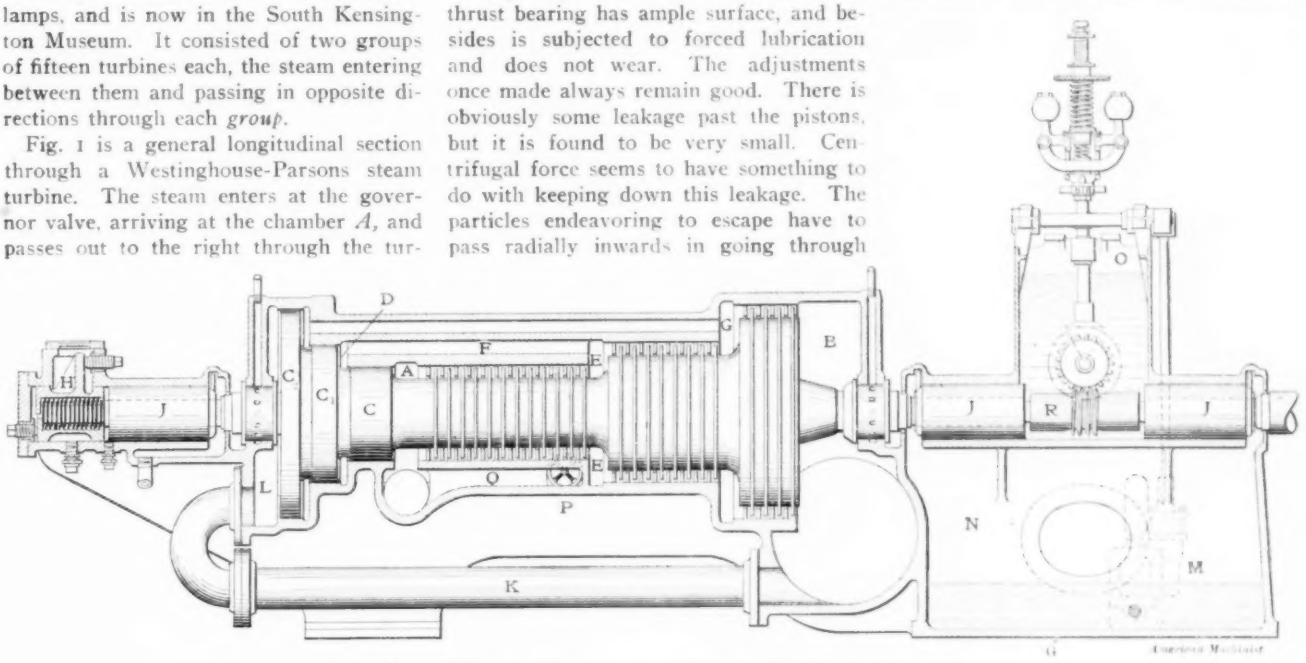


FIG. 1. LONGITUDINAL SECTION OF THE WESTINGHOUSE-PARSONS TURBINE.

At *R*, Fig. 1, is shown a flexible coupling by means of which the power of the turbine is transmitted. In small sizes the two shafts have a square cut on the ends, the coupling itself somewhat loosely fitting over these. In the larger sizes it is generally a modification of this arrangement.

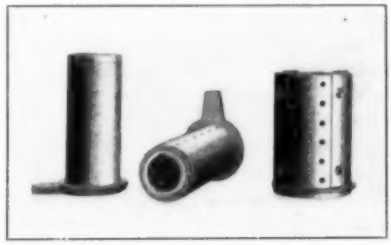


FIG. 2. BEARINGS OF THE WESTINGHOUSE-PARSONS TURBINE.

The governor gear and oil pumps generally receive their motion through a worm wheel, gearing into a worm cut on the outside of the coupling.

At *N* is an oil reservoir into which drains all the oil from the bearings. From there it runs into the pump *M* to be pumped up to the chamber *O*, where it forms a static head which gives a continuous supply of oil to the bearings. The

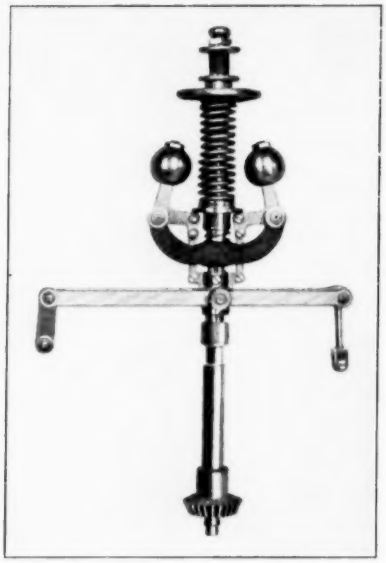


FIG. 3. GOVERNOR OF THE WESTINGHOUSE-PARSONS TURBINE.

pump is single acting, of the simplest possible construction that will not become deranged. The oil runs in by gravity, so that it is unlikely to fail to pump continuously.

A by-pass valve *P* is provided, which admits high-pressure steam by means of port *Q* to the steam space *E*. By opening this valve as much as 60 per cent. overload may be obtained, and in the case of turbines operating condensing, full load may be obtained should the condenser be at any time inoperative, from any cause, and the turbine allowed to exhaust into the atmosphere. Naturally, the effect of opening the by-pass valve is to reduce the economy to an extent that will be seen later when discussing economy.

The glands consist of packing rings set in grooves cut in the shaft. The rings press outward and remain stationary. Any form of frictionless packing necessarily leaks a little. In the case of the turbine exhausting into a vacuum, a little live steam is admitted between the rings by means of a small reducing valve, so that the leakage consists of a negligible quantity of live steam, instead of air, which would impair the vacuum. In case of the turbine exhausting against anything above atmospheric pressure, a small ejector is provided, which drains the leakage steam from between the packing rings and allows it to drain through a suitable drain pipe instead of escaping into the engine-room.

In all engines the governor is an important feature. A fly-ball type of governor is made use of, shown in Fig. 3, having several features conducive to good regulation. The ball levers are swung on knife edges in lieu of pins. The governor works both ways; that is to say, the midposition of the levers admits a full head of steam to the turbine. A movement from this in either direction tends to cut off the supply. This serves a useful purpose in the event of a very excessive load coming on the turbine, such as one due to a short circuit, which has the effect of bringing down the speed more than the percentage of variation permitted by the adjustment of the spring and shuts off the steam at once. Again, in such an event as some of the governor driving mechanism becoming broken and the governor balls slowing up independently of the turbine, the steam is shut off before any damage can take place.

The speed of the turbine may be varied within all the limits of the governor spring while the turbine is running. This is particularly useful in bringing alternations in synchronism and in adjusting their differences of load when in multiple. This is accomplished by grasping the top knurled head, when, by reason of a ball bearing shown, the spring and tension nuts remain stationary. Any adjustment of the spring nuts may then be made, without in any way disturbing the running of the turbine, other than making the change that may be desired.

The arrangement of the governor levers is shown diagrammatically in Fig. 4. They are attached to a small relay valve *A*, which controls the admission of steam below the piston *E*, which is directly connected to the main admission valve. The levers receive reciprocating motion at *C* from an eccentric, and use the governor clutch as a fulcrum, points *D* and *E* being fixed. Continuous reciprocating motion is thus given to the relay valve, which is in turn transmitted to the admission valve. The function of the governor is to vary the plane of oscillation of the relay valve, which causes the admission valve to remain open for a longer or shorter period, according to the position of the governor. The steam, therefore, is admitted to the turbine in puffs, which occur at constant intervals of time, but are of long or short duration, according to the load. At full load the puffs merge into an almost continuous blast. If we were to attach an indicator to the steam space A, Fig. 1, and pull the drum around by hand, we would produce a series of cards similar to the upper line of Fig. 5 when running under full load, and similar to the lower line when running under light load. This does not mean that in the latter case there is a more complete expansion of steam than in the former, but that high-pressure steam is made use of at all loads. The complete expansion of the steam is taken care of in the blades independently of the governor.

The advantages of this intermittence are threefold. The turbine at all times uses boiler-pressure steam, no matter what the load may be. The admission valve is continuously in motion, and consequently gets no opportunity to get stuck. The power to work the relay valve and overcome the inertia of the levers is transmitted through the governor clutch; hence the balls are moved in and out a very small amount at every oscillation of the levers, so that the governor levers, in respect to their motion about their points of suspension, are never at rest, and consequently when a change of load comes, the governor does not have to overcome the friction of rest, and is always ready to go to its new position. These features are particularly valuable. So long as a piece of mechanism is continuously working, we at least know that it is in a condition to continue working and is not stuck.

There is absolutely no variation of angular velocity in the turbine, corresponding to that due to the varying crank effort in reciprocating engines; hence the value of turbines for running alternators in multiple. This can be realized when we know a 50-horse-power turbine will run 20 minutes

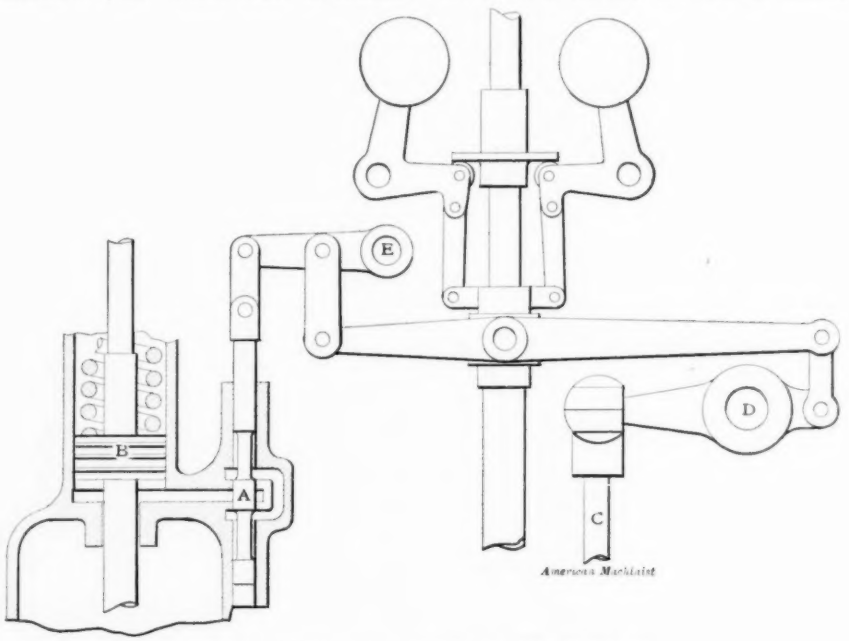


FIG. 4. MECHANICAL ACTION OF THE GOVERNOR.

after the throttle has been closed. This, of course, speaks well for the low friction, but it is principally due to the tremendous flywheel effect of the shaft. All the power is transmitted rotatively—there are substantially no reciprocating parts and no vibrations, and hence no costly foundations and no holding-down bolts are necessary.

Mr. Parsons made very successful use of an electrical governor which was attached to a relay valve working in exactly the same manner as just described. The arrangement of the levers is shown in Fig. 6. Reciprocating motion was given at *A*, points *B* and *C* being fixed. On the extreme right is hung, by means of a spring, a core working in a solenoid. When in operation the relay valve *D* oscillates continuously, and the core moves a very small amount by reason of its mass. At the same time it is ready to respond to any change of magnetic pull. One great feature of this governor is that the solenoids may be compounded so as to give constant electro-motive force at the terminals of the generator, the turbine running faster at full load than at light load to make up for copper losses in the armature. The governor may be further over-compounded to give any percentage of rise, just the same as an over-compounded generator.

In alternating current work the series coil is obviously separated from the shunt coil. This latter is in shunt with the exciter, and the series coil is usually placed above, having a separate laminated core.

The adjustment of variations of electro-motive force between no load and full load may be conveniently made by changing the amount of iron in the series core.

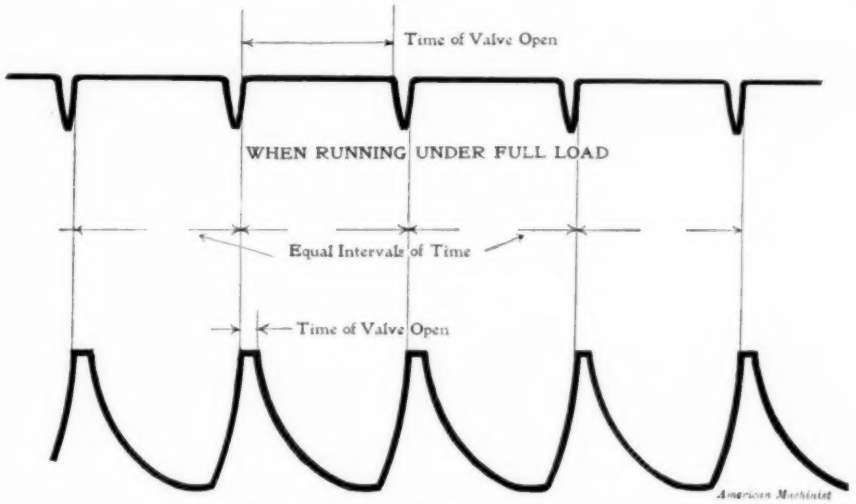

Time of Valve Open
WHEN RUNNING UNDER FULL LOAD
Equal Intervals of Time
Time of Valve Open
American Machinist
WHEN RUNNING UNDER LIGHT LOAD

FIG. 5. ACTION OF GOVERNOR ON STEAM SUPPLY.

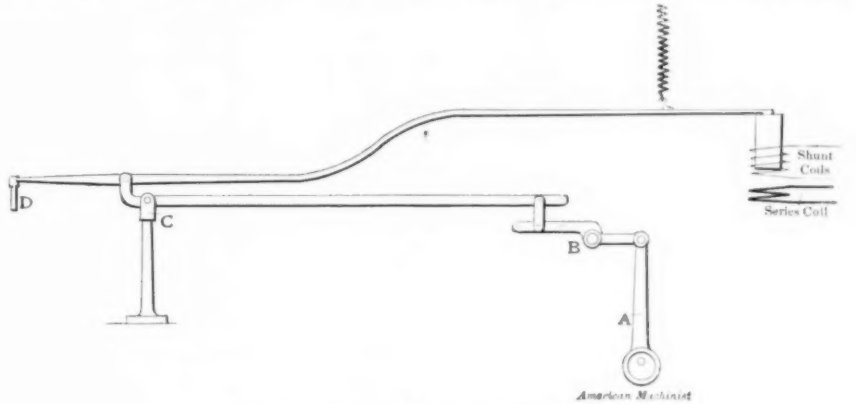


FIG. 6. ACTION OF ELECTRICAL GOVERNOR.

The essential parts of the turbine are, of course, the blades and buckets. They are made of hard-drawn material, and vary in size from ½ to 7 inches, according to where they are to be used. Every row of these blades has passages of increased area, corresponding with the volume of the steam. This increase of volume is obtained by increasing the hights of the blades, and when these have reached the desired limit, the diameter of the turbine is increased and the steam permitted a higher velocity that enables the blades to recommence another progression.

Considering one barrel of the turbine, the fall of pressure, or to be more exact, the coefficients of expansion, are the same for every row.

Referring to diagram, Fig. 7, the steam at pressure P' in expanding through row 1 to pressure P_1 converts its energy into velocity and impinges upon the moving blades of row 2. The steam then performs a second expansion in expanding through row 2, again converting its energy into velocity; but this time the energy of the efflux is to react upon the blades from which the steam issues. The same cycle is repeated in rows 3 and 4, and so on until exhaust pressure is reached. The moving blades therefore receive motion from two causes, the one due to the impact of steam striking them, the other to the reaction of the steam leaving them, and in this respect is this turbine a combination of Bianca's wheel and Hero's engine.

Many people suppose that these blades wear under the action of steam, but experience shows that they do not. In the case, however, of a nozzle, as in the De Laval turbine, in combination with the blades, the result is very different, because of the tremendous velocity of the steam. The wear even then is not great when superheated steam is made use of, but with any entrained water the wear is quite rapid. In the Parsons turbine the velocities of steam never exceed 500 to 600 feet per second, and for the most part are considerably less than this.

The blades are secured by caulking. Experiments show that the pull necessary to pull them out is as much as the elastic limit of the material of the blades themselves. The strain to which they are subjected in practice is about one-fortieth of this.

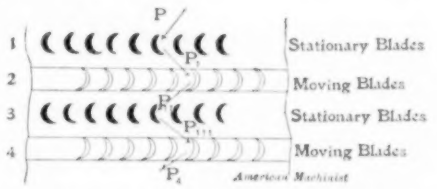


FIG. 7. DIAGRAM OF MOVING AND STATIONARY BLADES.

Danger of the blades colliding sideways is very remote. The smallest blades have ⅛-inch clearance sideways, and the largest as much as ½ inch. These dimensions are far beyond the limits of lateral motion permitted by the balance pistons. Of course, accidents do happen to the blades, but they are generally attributable to carelessness, such as the machine having been taken apart and, in handling, some of the blades damaged, the machine being again assembled without having the damage repaired. The result of this, however, is less serious than would be expected. At the most, two or three rows are ripped out. The blades are very tough, and the first broken blades close up the passage in the succeeding guide blades and prevent the broken pieces passing and causing more damage.

In the event of such an accident, the damaged blades may be removed and the machine put into service when full power

can be developed, but, of course, at a somewhat reduced efficiency, according to the number of rows missing. The blades may be permanently repaired in a very short time by chipping out the grooves and inserting new blades. This work can be done wherever the machine may be in service, as no special machine work is necessary. Such accidents, however, are among the improbabilities.

It may be interesting to record the actual pressure exerted on individual blades in a turbine. Take, for example, one of 300-kilowatt capacity. There are altogether 31,073 blades in the turbine, of which 16,095 are moving blades. The pressure that each of them exerts in revolving the shaft varies from .89 to 1.04 ounces.

The steam inlet is always provided with a steam strainer, which is intended to prevent foreign substances from getting into the turbine by means of the steam pipe. Generally such things as nuts, bolts, monkey-wrenches, etc., as have occasionally been known to come through a steam pipe, cause practically no damage, because they cannot pass the first row of guide blades. The greatest inconvenience of this nature arises from small pieces of gasket closing up the guide-blade passages, which brings down the power appreciably.

Laying Out Screw Conveyors.

BY J. A. BROWN.

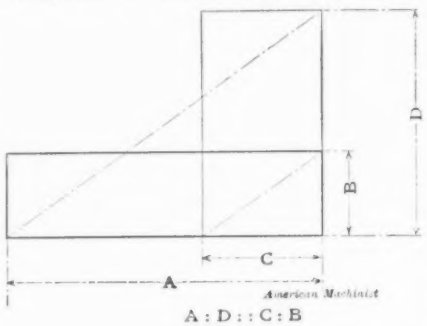
Some time ago Mr. J. H. Barr, illustrated a very useful graphical method of constructing on a given line a rectangle equal in area to a given rectangle. The diagram, Fig. 1, will serve to recall the principle.

This method, when applied to the problem of developing the cross-section of conveyor spirals, shown in issue No. 43 of last year, will, to a certain extent, shorten the work and give a more complete graphical solution. From the conditions given, the length of any helix multiplied by the thickness at its radius is constant.

Using the same construction as in Fig. 1, we may, in Fig. 2, make $A\,S$ equal to the inside radius or radius of core, and $A\,C$ equal to the outside radius; $S\,C$ being the width of the blade. On a perpendicular through A, make $A\,B$ equal to the pitch divided by 2π. Divide the width of blade into any convenient number of parts, as at J, I, H, G, and from B as a center and with radii $B\,S$, $B\,J$, $B\,I$, etc., describe arcs cutting the perpendicular in S', J', I', etc. Through C' draw a horizontal line $M\,N$.

Since $B\,S'$ is proportional to the length of the helix at the inside edge of the blade, we may draw $B\,P$ proportional to the original thickness of the blade and then the rectangle $B\,P\,L\,S'$ is proportional to the sectional area of the sheet from which the blade is rolled. From the method of manufacture, this is a constant quantity, the length of the helix increasing and its thickness diminishing as the distance from the center or core increases. At the outside edge the length of the helix is proportional to $B\,C'$.

We then have the rectangle $B\,P\,L\,S'$ given and the side $B\,C'$ on which to construct a rectangle equal in area to $B\,P\,L\,S'$. The problem is obviously identical with that shown in Fig. 1, and the work may be completed as follows: Draw $P\,C'$ and a



$A : D :: C : B$

$\therefore A\,B = C\,D$

FIG. 1. CONSTRUCTING A RECTANGLE $A\,B$ EQUAL TO A GIVEN RECTANGLE $C\,D$.

parallel to $P\,C'$ through the point S' intersecting the line $B\,P$ in O. Then $B\,O$ is the side required, and the rectangles $B\,O\,M\,C'$ and $B\,P\,L\,S'$ are equal in area, $B\,O$ being the corresponding thickness of the helix $B\,C'$. It is now required to find the thickness corresponding to the helices $B\,G'$, $B\,H'$, etc. The work may be completed by applying the above construction to the points G', H', etc., or, more directly, by drawing, from O as a center, diagonals through the points G', H', etc., intersecting on the horizontal line $M\,N$ the corresponding thicknesses to the same scale as $B\,O$ and $B\,P$, which may be read off directly.

In the illustration shown, the diameter of the core has been taken at 2 inches, the width of blade as 2½ inches, pitch 12 inches, and the thickness of plate 3-16 inch. The thicknesses at the other points in the finished blade are then found to be .168, .148, .130, .116 and .103 at the outer edge.

While aware of the long step between the "mechanically possible" and the "commercially profitable," an examination of Mr. Caldwell's method of rolling conveyor flights suggests the question: Could not the strip be so shaped originally that the stretching process in reducing the thicker edge would result in a finished section of approximate uniform thickness? In this way the metal would be thicker on the outer edge than at present and equalize the wear better.

Drawing, Forming and Beading Shells.

BY JOSEPH V. WOODWORTH.

In the following article a set of dies will be described for drawing, forming, beading and reducing a flat blank of soft sheet brass 3 inches in diameter and No. 24 gage to the finished shape shown at G, Fig. 1. The successive shapes from the beginning are also shown in Fig. 1 and designated by the lettters A, B, C,

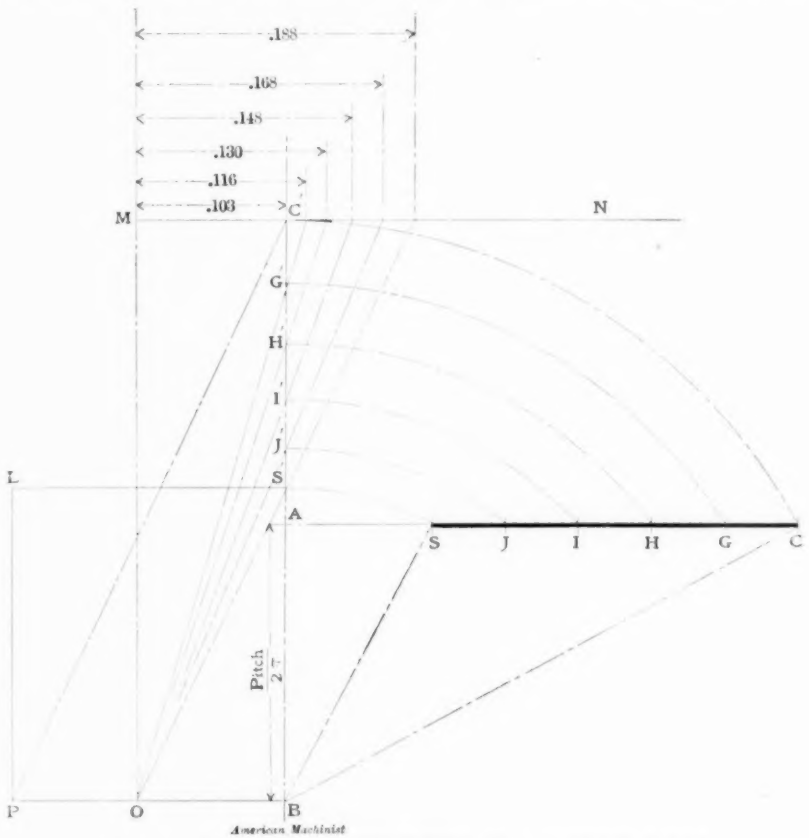


FIG. 2. FINDING THE CROSS-SECTION OF A CONVEYOR FLIGHT.

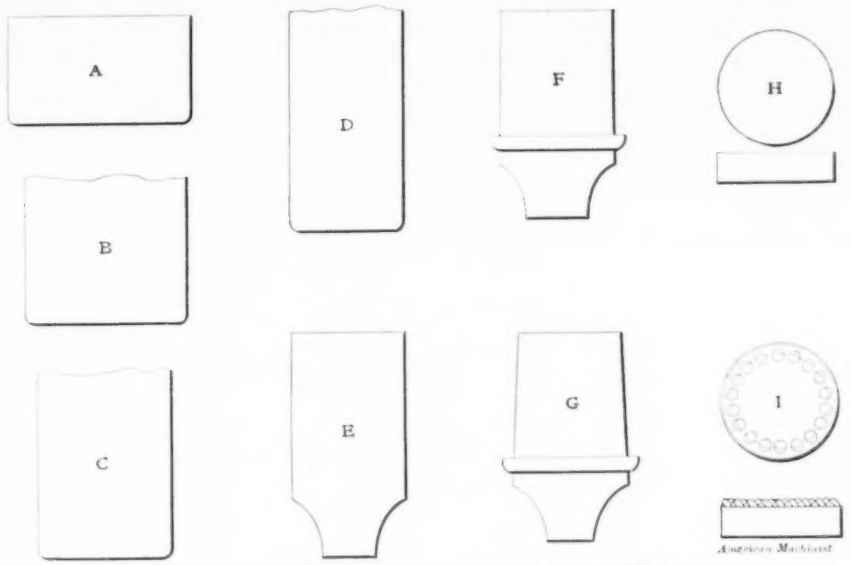


FIG. 1. SHOWING SUCCESSIVE DRAWING OPERATIONS.

etc. *H*, in the same figure, shows a cap with a circle of beads on the top, the production of which will also be described.

Fig. 2 shows the punch and die for the first operation of blanking and drawing the shell. As this was done in a single-acting press it was impossible to draw a shell more than one inch high. The tension for holding the blank while being drawn up into the punch is received from the rubber spring *G*, which in this case was 3 inches in diameter by 6 inches long. The blank being held between the face of the punch *H* and the blank holder ring *C* the punch in descending causes the rubber *G* to compress, and as it continues down the tension on the blank increases so that when it has compressed 7/8 inch or 1 inch it is so great that either the metal stretches and becomes thinner or else the internal punch *B* pushes through the bottom of the shell, spoiling it of course.

For increasing the hight and reducing the diameter of the shells, reducing dies of the style shown in Fig. 3 were used. A tool steel blade for the die *K* was turned up and bored out to the size of the shell *B*, Fig. 1, and nicely rounded at the outer edge. It was then undercut at the back at *L*, leaving a dead sharp edge. This was to strip the work from the punch without bruising it. A gage plate *M* for the shell *A*, Fig. 1, to rest in, was fastened to the face of the die by screws *N N*. The die *K* was then polished, leaving the inside very smooth and hardened. The punch *O* was then made and finished two thicknesses of metal less in diameter than the die and rounded at the corner.

Three dies of this type were necessary to produce the shell *D*, Fig. 1, which was 1 inch in diameter by 2 1/8 inches high. The upper edge of this shell was then trimmed off and the bottom drawn and formed to the shape *E* by the punch and die shown in Fig. 4. *P* is the die of tool steel, and it was the only die required for the three succeeding operations. It was first fitted to a bolster and then turned and finished, the shape being worked out to a templet, as shown; it was also bored to admit the knockout *R*. A recess was turned on the face at *Q Q* as a gage for centrally locating the punch by means of a collar which fitted within this recess in the die and also around the punch. This die was then highly polished and hardened; the knockout R was made and finished to shoulder within the die and serve as the bottom of it. The spring *S* was then made of strong spring wire and placed within the die. A hole was drilled in the end of the stem of the knockout for the pin *T* which prevented the knockout from rising too high. The punch *U* was then made, its diameter fitting the inside of shell *V* and formed at the bottom to templet two thicknesses of metal less than the die. It was hardened and polished dead smooth, as a slight scratch is enough to cause the work to stick tight. In operating, the shell *V* was slipped on over the punch *U*, and in descending it was formed and drawn into the die *P*. As the punch rose the knockout *R* relieved the work from the die and it then rose with the punch, from which it was

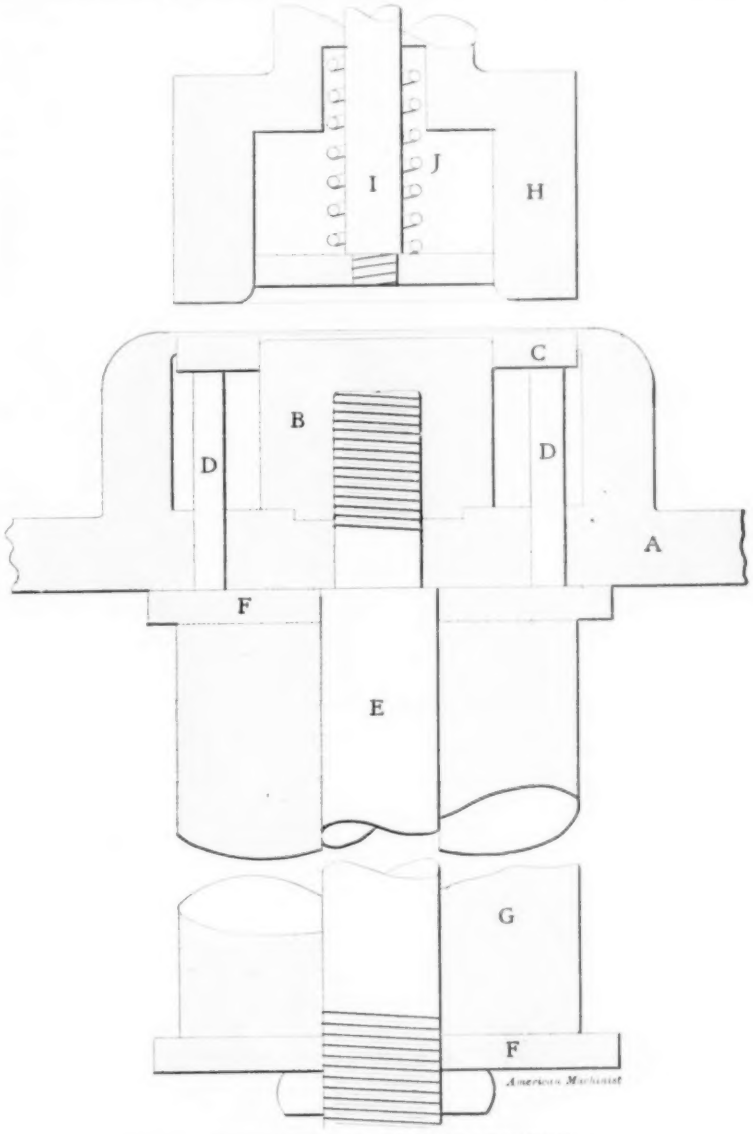


FIG. 2. COMBINATION DIE FOR FIRST OPERATION.

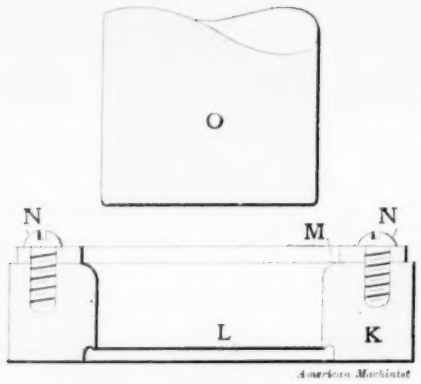


FIG. 3. FIRST REDUCING DIE.

easily removed by hand, leaving a shell of the shape *E*, Fig. 1.

The next operation, that of throwing out and forming the bead first shown at *F*, Fig. 1, was accomplished by the use of the double punch shown in Fig. 5, the the same die employed in the preceding operation being used. The well-known principle that sheet metal, if properly forced, will flow wherever there is an opening was the basis for the operation. As will be seen in Fig. 4, the form of the bead is worked out in the die *P*. In Fig. 5 the internal punch *W* fits the inside of the shell *V* and it is finished dead smooth, the outer punch, or force, fits the punch *W* at the top shoulder and also fits around the outside of the shell *V*. This also was finished dead smooth and a sharp square corner was made at *A* for the top of the shell to rest against. These parts were assembled as shown and located centrally within the die *P*, Fig. 4, the outside of the force *X* fitting within *Q Q*. The shell *Y* was then slipped up within *X* and, the punch descending, the metal was forced down and flowed into the bead in the die *P* until the punch *W* bottomed, filling out and forming the shell as shown in *F*, Fig. 1. When the punch ascended, a knockout on the back of the press worked the stud *B*, forcing it downward and stripping the shell from the punch.

The next and last operation, that of tapering and reducing the upper half of the shell, as shown at *G*, Fig. 1, was done by means of the hollow taper punch, Fig. 6. The shell being set within the die *P* and the punch centering itself by *D D* coming within *Q Q*, the shell was gradually reduced to the space *G*, Fig. 1; the knockout, worked by the spring *C*, stripping it from the punch. The shell was then complete; both ends were retrimmed and the lower end was tapped to admit a tube. The upper part of the shell was tapered as here shown to allow a case to be slipped over and tighten itself at *B*.

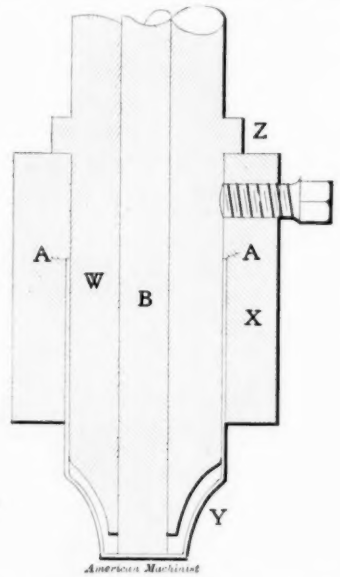


FIG. 5. PUNCH USED FOR FORMING BEAD.

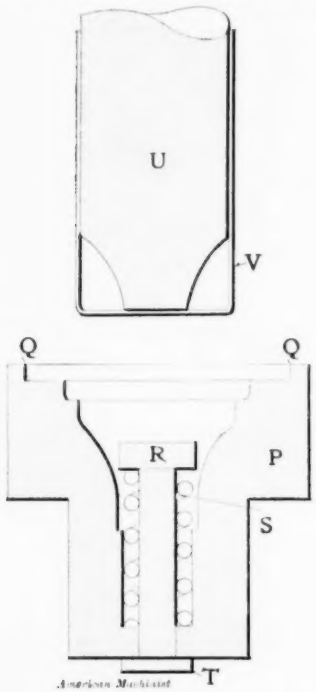


FIG. 4. DIE FOR DRAWING LOWER END.

The cap shown at *I*, Fig. 1, was made in two operations. The blanking and drawing to size were done by a die of the type shown in Fig. 2. It was to fit tightly over the upper end of the shell *G*, Fig. 1. The second operation, of throwing up and piercing the projections, was done in the piercing die shown in Fig. 7. In this die the usual positions of the punch and die were reversed, the punch being below and the die above. At first a bolster *F* of cast iron was bored and faced as shown, and the holder *G* for the punches of tool steel was turned up and fitted to it. The holder *G* was then laid out for the holes for the punches, which were nineteen in number, by indexing on the milling machine. They were then drilled through and reamed to size and the holder was hardened. The holes for the die *L*, which had been made of tool steel and fastened within the holder *N*, were then transferred through the holder *G* to the face of the die at *M M*. These were then reamed and finished to size and left straight. The die *L* was hardened and drawn to a light straw color and the face was ground. Nineteen punches all of the same length, of Stubs steel, were finished and sheared on the side as shown at *H H*, each one exactly the same amount. They were then hardened and drawn to a blue and driven in tightly in their rela-

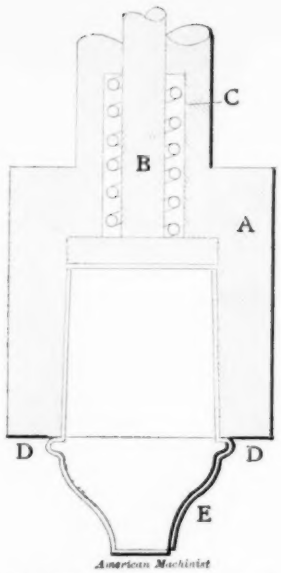
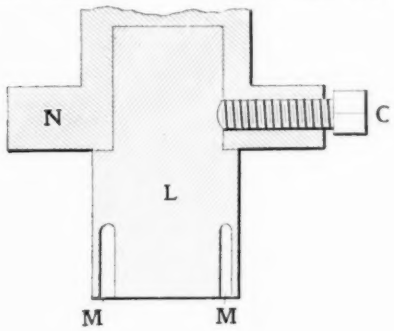
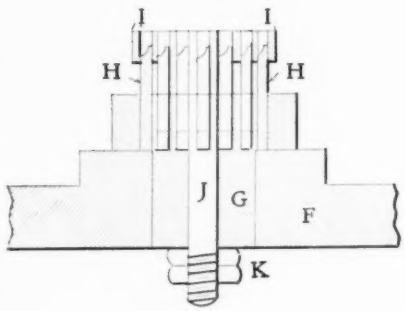


FIG. 6. FOR TAPERING UPPER PART OF SHELL.





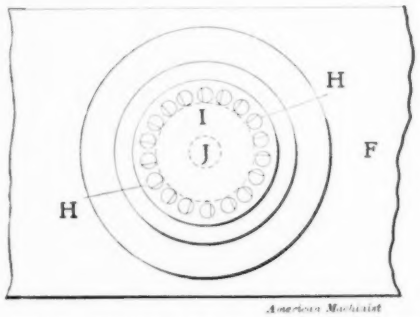


FIG. 7. PUNCH AND DIE FOR PERFORATING THE CAP.

tive positions within the holder *G*, resting on the face of the bolster *F*. The stripper *L*, of flat machine steel, was then made to fit freely over the punches *H H* with a stud *J* fastened in the center and fitting freely within a hole in the bolster *F* and with two jam nuts *K* to prevent its rising too far. The outside of the stripper or gage plate fitted nicely within the cap to be pierced. The punch and die were set up in the press, the cap was placed on the stripper *I*, and, the die descending, it was held between the two, and the punches pierced and pushed the projections up into the die, which was set so that the punches would enter it far enough to just leave a section of each of the projections united to the cap and leave all of them standing off at the same angle. When the die rose, a spring within the circle of punches caused the stripper to rise and strip the cap from the punches. It was then left sticking to the die, from which it was easily removed by hand. The projections thus made on the cap served as vents and directors for small jets of gas as part of a special gas burner, causing them to be directed off at an angle and thereby increasing their range.

The Catlin Keyseater.

We illustrate an interesting keyseater of the vertical draw-stroke type, which should prove a serviceable machine where much of such work is to be done. It not only does the actual work expeditiously, and with sufficient precision, but the time consumed in placing and securing the work and in removing it when done, also in changing the cutting tools for different widths of keyseat, is in this type of machine reduced to the minimum. The vertical bar which carries the cutter is secured to a vertical sliding piece below, upon which is a rack operated by a pinion as the end of the train of gearing and shafting. The stroke reverses something like that of a planer by means of adjustable dogs on the grooved face of the disk at the end of the pinion shaft, as seen in Fig. 1. These dogs move in alternate directions the horizontal rocking shaft, and in Fig. 2 is seen the connection from this shaft to the friction clutches of the driving pulleys. The difference in the diameters of these pulleys is for the purpose of obtaining a quicker speed for the return stroke of the cutter, this of course being secured from the smaller pulley. This mode of driving the cutting bar gives a strong pull for the tool and a uniform cutting speed, regardless of the length of the stroke, so that no speed-changing devices are required. The motion of the cutter may be reversed or stopped by means of the hand lever attached to the disk.

The cutter bar, which is round, slides in a flanged bushing on the top of the machine. The outside of the hub of this bushing fits the hole in the piece to be keyseated, so that various bushings are provided for the different sizes of holes. The outside of the bushing is eccentric to the spindle hole, the thin side coming where the bushing is slotted for the keyseat, so that the tool may be as short as possible. The outside of the bushing is also turned obliquely to the spindle hole when required to give taper or draft to the keyseat. The mode of setting out the cutting tool was described on page 870 of our last volume, when the patent for it was new. The small screw at the top of the spindle is gradually fed down by hand, the oblique face of the block at the end of it bearing upon the oblique end of the cutting tool, the spring which presses the tool upward doing little more than to carry the weight of it, so that it allows the tool to spring away from the work on the return cut. This arrangement also permits the easy removal of the tool for grinding or for changing to one of another width.

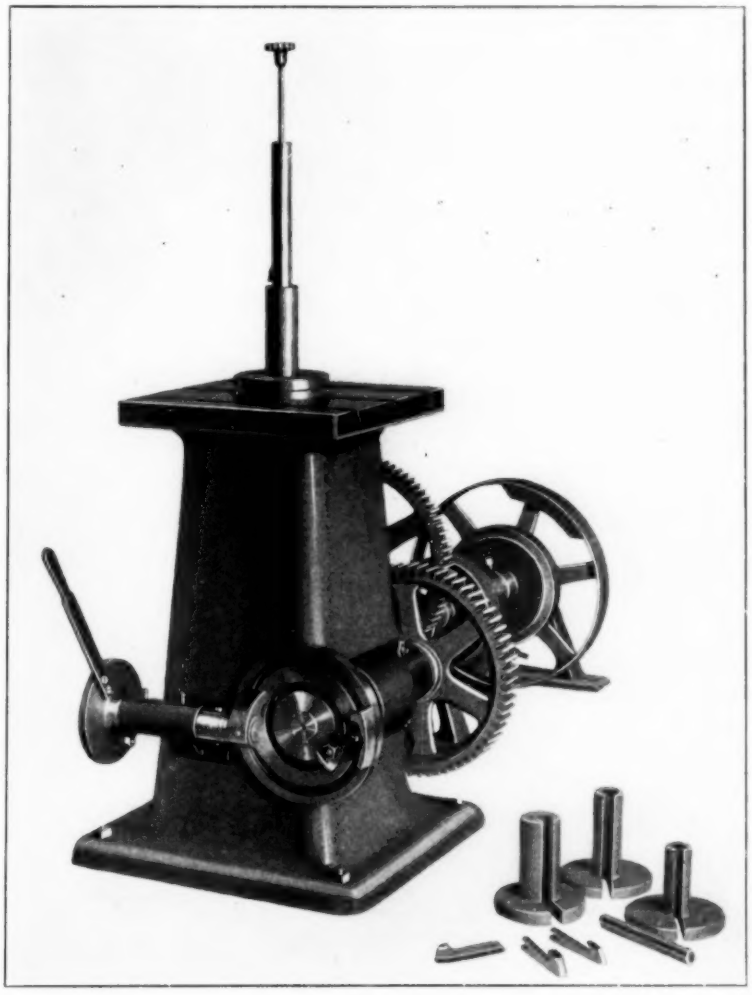


FIG. 1. THE CATLIN KEYSEATER.

The machine is made in four sizes, the smallest of which cuts from ⅛ to ¾ inch wide by 10 inches in length, and the latter from ⅛ to 3 inches in width by 30 inches long. To give an idea of the speed of the machine, the makers state as follows: "This machine has, in a cast-iron hub, cut a keyseat 10 inches long, 1½ inches wide and 7-16 inches deep in three minutes. In the hub of a cast wheel, a keyseat was cut 6 inches long, 1 inch wide and 7-16 inch deep in three minutes. Twenty miter gears 8 inches in diameter were keyseated in twenty minutes; size of each keyseat, 2½ inches long and ½ inch wide." This machine is built by the Chattanooga Machinery Company, Chattanooga, Tenn.

Brass Scrap.

BY C. VICKERS.

In the process of turning and finishing brass castings, considerable quantities of chips are produced which have to be used up by the brass founder. If these chips were always clean, their disposal would not present serious difficulties; but, however careful the finisher may be, the chips always contain some iron, which must be removed before melting. This is effected by hand magnets or by magnetic machines. In any case, the iron or steel is only partially removed, as the more minute particles are very successful in eluding the magnets, and if the metal when so cleaned is used for small castings that are to be rapidly machined, the presence of these

small particles of iron becomes a serious matter, because they do not melt and alloy with the brass, but are held in suspension and are distributed by the stirring, skimming and pouring throughout the metal, and are found imbedded in the castings in small specks of extreme hardness, and when these specks come into contact with a delicate tool, that tool will suffer, if it is not utterly ruined. The loss is often serious, as in many cases the tool has been made especially for the particular job and would have lasted the job out if the metal had been clean and soft.

When it is necessary to use chips in small castings, chemical means can be resorted to to remove the finer particles of iron. They may be rusted out by mixing the chips with salt, wetting with water, letting stand for a few days and then washing in running water. A quicker, and by some claimed a better way, is to first remove grease either by burning or by the use of lye or common soda, and afterward to boil the turnings in a strong solution of alum.

If the founder is making castings of a low grade, with little machine work on them, the disposal of chips is an easy matter, as, after the bulk of the iron has been removed by magnets, they are clean enough for his purpose. His trouble is merely one of melting. There are several methods of disposing of this difficulty. In some shops the furnace-tender and his helper will occasionally work evenings or on Sunday, running the chips into ingots. Another plan is to fill up the worn-out crucibles with borings and set them in the fire at night, after the regular heats are out, throw in a little fuel, open the drafts, and leave until morning, when the crucibles are broken open and the metal is obtained in the shape of a "heel." Still another method is to put a given quantity of chips in every pot when charging.

In pouring metal, it is not always possible to avoid spilling some; if this spilled brass is not promptly cared for it becomes a source of loss. Although it may not be convenient to sweep the shop oftener than once a week, the larger pieces of brass should be collected every morning and used up during the day. The sweepings should be sieved to remove the brass, which is washed, cleaned of iron and promptly used up. The sand may be used in core-making or thrown away, according to circumstances.

Considerable is lost by abrasion on emery wheels. This is difficult to utilize, as it is intimately mixed with emery. Owing to this, it is not easy to melt and is often allowed to accumulate, until its disposal becomes a serious problem. Unless it is saved for a definite purpose, it should be constantly used up by putting a little in each pot. Some firms use this dust in making thimbles for plumbers and save it for that purpose, mixing it with other scrap metal. If it is allowed to accumulate in any quantity, it is best to dispose of it to the smelter.

Another thing that will bear constant watching is the hearth on which the pots are skimmed. It ought to be cleaned every morning, the ashes being sieved and all cleaned metal and coke picked out. The residue is used to pack among the castings in the tumbling barrel, where it helps to polish the castings and is itself cleaned in the process. When it has become bright and clean, it should be picked over and the iron and clinkers removed, after which it may be divided among new metal or run into ingots.

Old crucibles should be broken up and cleaned of the metal adhering to the sides, and when the ashes are removed from the furnaces all the clinkers and pieces of brass are picked out. The clinkers ought to be pulverized, by tumbling dry, with heavy pieces of iron, and the resulting dust sieved to recover the brass, which is generally found in the form of small shot.

Aluminum should be skimmed on a separate hearth and the skimmings cared for separately, for if mixed with the brass it causes discoloration.

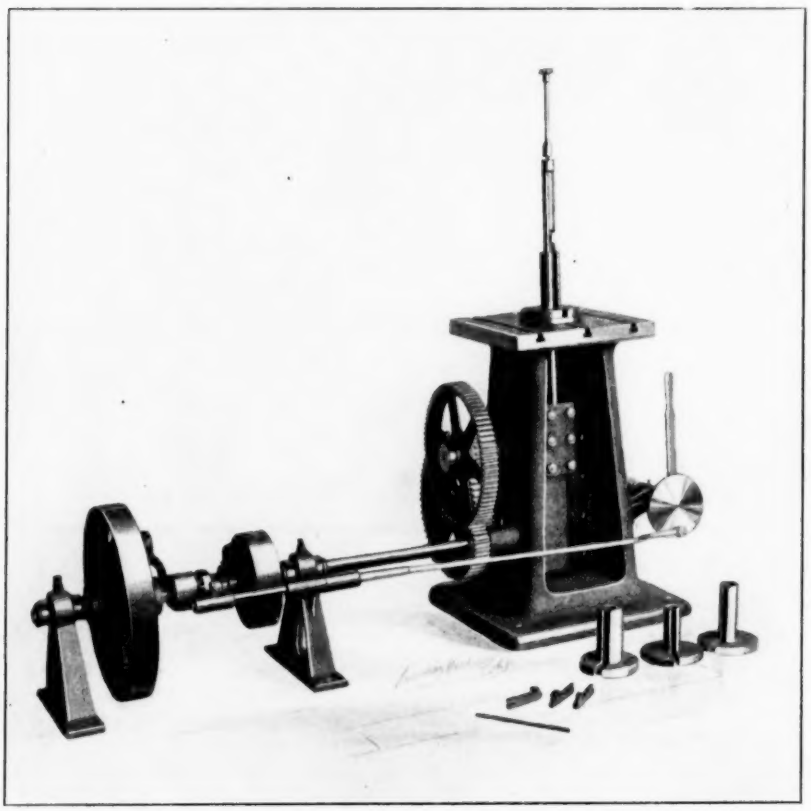


FIG. 2. OTHER SIDE OF CATLIN KEYSEATER.

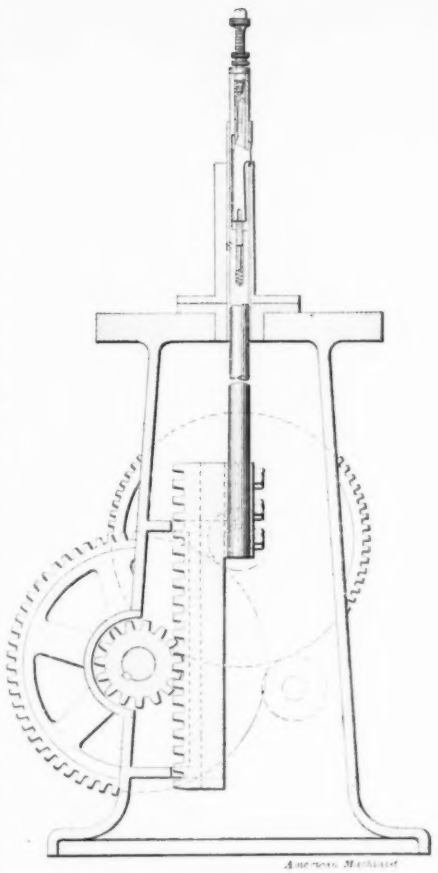


FIG. 3. VERTICAL SECTION OF KEYSEATER.

The Bilgram Automatic Generating Gear Cutter for Spur and Spiral Gears.

The Bilgram machine for generating the teeth of bevel gears is well known to all well-informed mechanical men. When it appeared it embodied a principle which was then new, and the resulting machine has received well-deserved recognition. Anything done by Mr. Bilgram in this field possesses wide-spread interest, and it

is with real pleasure that we show herewith his latest production—an adaptation of the principle of the bevel-gear machine to the cutting of spur and spiral gears. While the principle of this machine is the same as that of the one for cutting bevel gears, there is a change in its application which results in an automatic machine. This change can best be explained by reference to Fig. 1, which shows the progressive action of the tool in cutting a tooth space.

FIG. 1. ACTION OF THE TOOL IN GENERATING A TOOTH.

The action of a generating tooth cutter is now so well understood that it is unnecessary to describe it here in minute detail. Fig. 1 shows the cutter *a*, which is a reciprocating or planing tool having the profile of a correct rack tooth—namely, a truncated, straight-sided wedge. While this tool reciprocates, it also travels slowly to the right, the blank meanwhile turning under it, the motion being that which would exist were the tool a rack tooth and the blank a gear. During this combined movement the tool cuts the tooth space in the manner indicated. In Mr. Bilgram's bevel-gear machine the tool does not move sidewise, the blank being rolled upon it as a complete gear might be rolled on a stationary rack, but in the spur-gear machine this action is reversed—the blank turning on a fixed center, while the tool moves over it, as it would be turned by a moving rack. It will also be observed that whereas the tapering form of the tooth space in a bevel gear compels the use of a side tool which cuts but one side of a space at a time, no such limitation exists with spur gears. The tool includes the profile of both sides of the rack tooth and cuts both sides of the space simultaneously. Moreover, with the spur-gear machine there is no preliminary gashing. The machine cuts the teeth from the solid blank.

Another and more radical change in the action relates to the action of the tool on the successive teeth. In the bevel-gear machine the tool completes the profile of each tooth space before beginning the next, but with the present machine, after each cutting stroke, and during the return stroke of the tool, the blank turns by a tooth space or is "indexed." The blank thus makes a complete revolution, during which a single cut is made in each space, followed by a second revolution, in which a second cut is made, and so on; a single traverse of the tool from left to right, as shown in Fig. 1, serving to complete the entire gear. It is through the utilization of this feature that the machine is made completely automatic.

Figs. 2 and 3 are elevations of the two sides of the machine. At *a* is the blank to be cut, mounted on a suitable arbor, and at *b* is the cutting tool, mounted on a ram *c*, which is driven through the rods and levers plainly shown by the driving pulley *d*. The ram slides in a guide *e*, which is vertically adjustable on the post *f* by the hand-wheel *g*, in order to adjust the machine for different sizes of gears to be cut. The tool will be seen to cut on the pulling stroke. It is mounted on an apron which is mechanically lifted during the return stroke to enable the tool to clear the tooth while the blank is being indexed for the next space. This lifting is accomplished by the long pinion *h*, over which the ram head slides. The pinion is driven by its shaft *i*, spiral gears *j*, shafts *k* and *l* and connecting rod *m*, which rod is driven by a small crank on the end of the driving shaft opposite the main pulley *d*. In point of fact, however, the simple crank shown

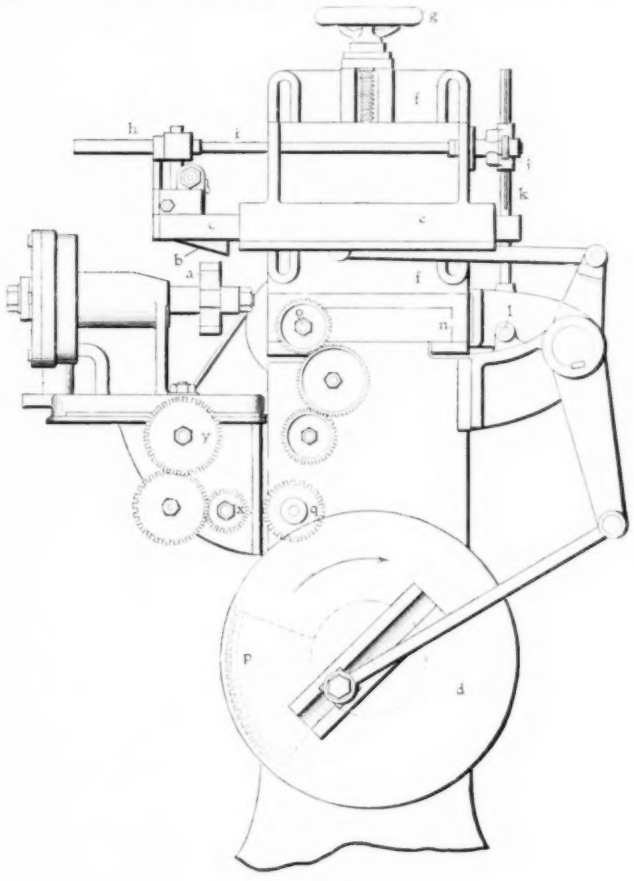


FIG. 2.

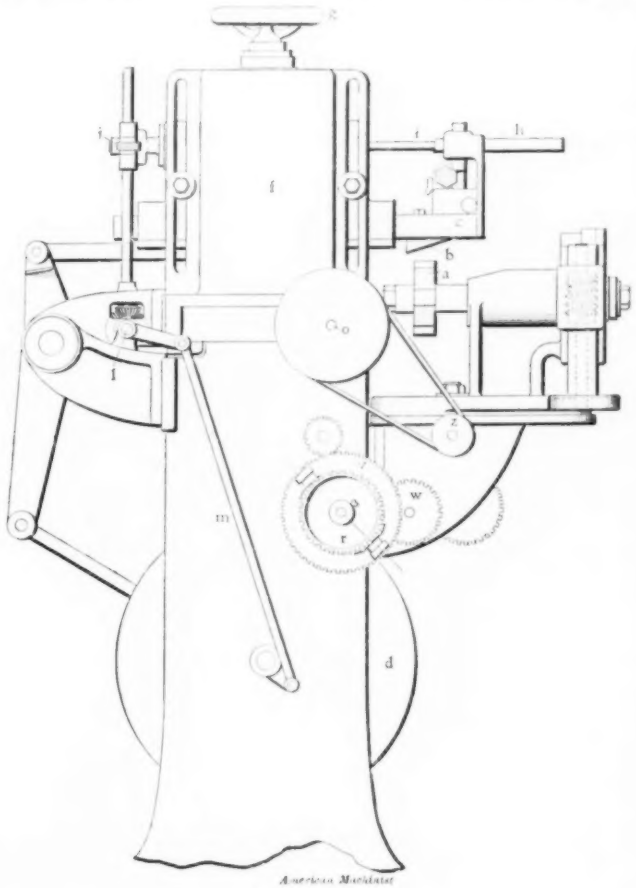


FIG. 3.

THE BILGRAM AUTOMATIC SPUR AND SPIRAL GEAR GENERATING MACHINE.

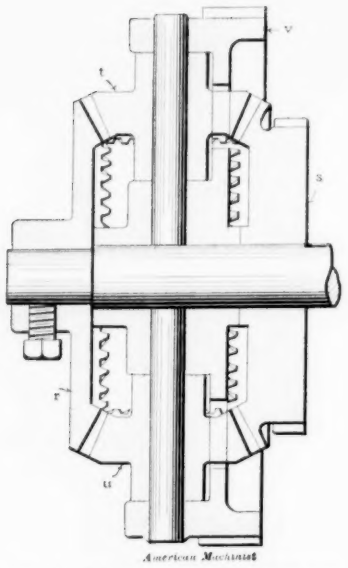


FIG. 4. DETAIL OF INDEXING TRAIN.

on this shaft is not used. In order to lift and drop the tool more promptly and give a more pronounced "dwell," a beautiful epicyclic train is employed in place of the crank. This train is too small to show in these views, and it is unnecessary to show it in detail, as we have already done so in our issue for August 4, 1898, under the title, "A Substitute for a Cam."

The sidewise feed of the tool mentioned in connection with Fig. 1 is obtained by sliding the post *f* on the planed top of the bed through the gibbed slide shown at *n*. This movement is accomplished through the screw, of which the end is shown in both Fig. 2 and Fig. 3, at *o*. A belt pulley on the end shown in Fig. 3 connects the screw with the indexing train of gears from which it is driven.

The indexing train begins with the toothed sector *p*, Fig. 2, secured to the driving pulley. At each revolution the sector drives the gear *q* an exact revolution. The actual construcion here again departs from the drawing—the actual detail at this point being of highly refined ingenuity. It was shown in our issue of June 30, 1898, in an article entitled "Three Modifications of the Geneva Stop," the construction used here being the third modification shown in that article. Its object is to insure an exact revolution of gear *q* at each action and to engage and disengage the gear without shock.

The shaft of gear *q* extends through the machine and carries, keyed to its opposite end, the bevel gear at *r*, Figs. 3 and 4. The construction shown in Fig. 4 is another beautiful piece of mechanism. On the shaft is mounted loosely a gear *s*, carrying both spur and bevel teeth, and connecting *r* and *s* are two idler bevels *t* and *u*, mounted on a sleeve which turns freely on the shaft. The gears *r*, *s*, *t* and *u* form the familiar "jack in the box." The pins which carry the bevel idlers also carry, through an extension of its rim, the spur *v*. If, now, the spur *v* be held stationary while *r* is turned through the action of sector *p* and gear *q* of Fig. 2, it is clear that *s* will be turned an equal amount in the opposite direction. The turning of *s* also turns *w*, Fig. 3, which meshes with it. On the other end of the shaft carrying *w* is a gear *x*, Fig. 2, which by the change gears shown and other gears within the head but not shown, is made to turn the blank by a single space. The change gears are of course changed to adapt them to the gear being cut. The shaft of the gear *y* of this train carries at its opposite end a belt pulley *z*. Fig. 3, which drives the feed-screw *o* to effect the slow horizontal feed of the tool. It is clear that this horizontal movement of the tool must be accompanied by a corresponding movement of the blank to represent the action of a rack on a gear, this movement being additional to the indexing movement. This is accomplished through the three change gears and idler shown in Fig. 2, the gear mounted on feed-screw *o* being the first of the train. The shaft of the lower gear of this train has at its opposite end a gear, shown in Fig. 3, meshing with gear *v* of Figs. 3 and 4. It is clear that the initial movement of the index train through the sector *p* will in the first instance index the gear, but this indexing movement, through the small belt, will turn the feed-screw *o*; and this movement of *o* being finally carried to *v* of Figs. 3 and 4, will cause an additional turning movement of the blank to correspond with the sidewise feed of the tool.

The construction of the work head is such that it may be revolved about a center bolt shown in Figs. 2 and 3 without affecting the indexing movement, and by setting the head at a suitable angle spiral gears may be cut with the same facility as spurs.

Fig. 5 is from a photograph of the actual machine, and shows it set up for the cutting of a spiral gear. The Geneva-stop addition to the indexing sector *p* of Fig. 2 will be seen alongside and above the belt pulley, the machine being photographed while in the act of indexing. The driving mechanism of the tool ram will also be seen, from this view, to include a Whitworth quick return.

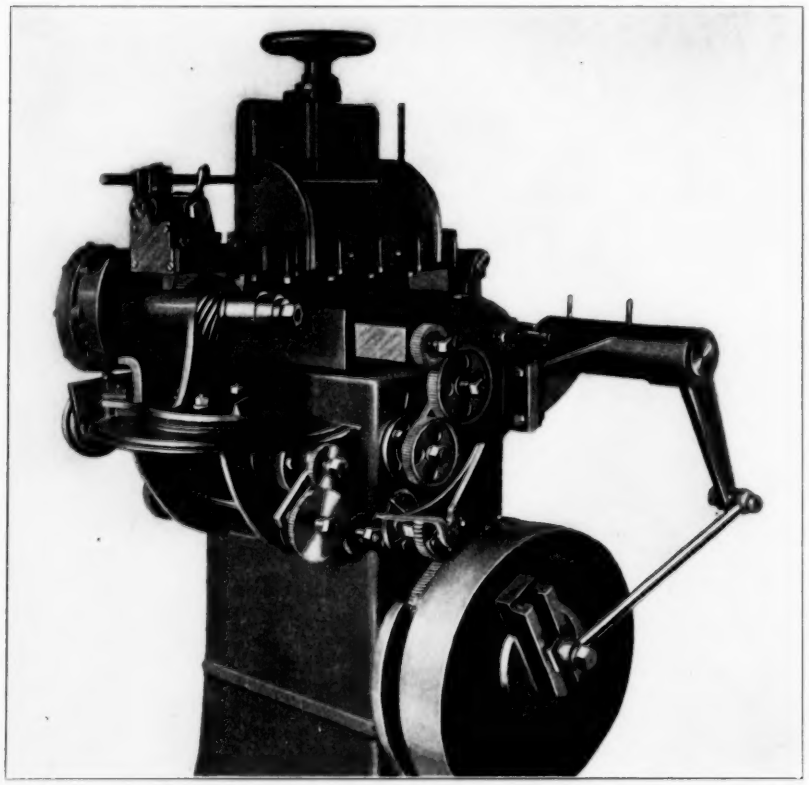


FIG. 5. VIEW OF COMPLETE MACHINE.

Echoes from the Oil Country.

THE "NOT BORN" MECHANIC.

Did you ever think that mechanics are like other great people—that they are born, like poets and musicians, I mean, and cannot be made?

Maybe you don't think so; but just you try to make a mechanic out of a boy who will put a ¾-inch bolt die into a pipe machine and calmly thread up a lot of ½-inch pipe nipples with it, after he had threaded the first end under instructions, and had then been called away on some errand and someone else had cut 1-inch pipe while he was gone, so that he had to change the dies, and then have him think it would not make any difference, anyway. When you think that this boy was raised where pipes are everywhere, had graduated from the common school and seemed perfectly frank and honest, if you

could make a mechanic of him you could do more than I ever could. That boy was clerking in a store the last I knew of him.

I wish everybody could get into the business they suited, or at least that the ones who are not suited to it could get out of the machine business; but they won't.

Someone wrote a while ago about the benefit of painting your work up nicely before letting it go out—said it would more than pay by the reputation for good work it would give, and so forth. I believe they told about someone that even painted up his rough castings before sending them out (some of ours need filler as well as paint). Anyhow, we were so impressed with the idea that we concluded to work up what steel-colored paint we had in the barrel and try to improve our work some. There was a painter around that hadn't much to do that used to be famous, so he said, in his younger days, who would be glad to do the final improving for us, and a little benzine and linseed oil and turpentine wouldn't cost much.

Do you ever think you had found the greatest blockhead in existence? Well, I found him, or at least his twin.

I watched the painter for a few jobs and saw that he could mix paint and put it on pretty well, and so I gave him quite a lot of work to do. Sometimes in a rush he would bring another man with him to push the work out quickly.

One day a customer came in filled with wrath, and, after cussing me and the shop until the expansion cooled him off somewhat, said he wanted to have a man go with him at once and get that loose pulley off and have it fixed; that it had cut the shaft all up and now was stuck; and what did I mean by sending out a pulley without oil holes? And he had a good mind to clean out the whole outfit; and if I didn't get a move on he would bring a suit for damages; and he wouldn't pay a cent for the fixing; I would have to do, etc., etc. You know how a man talks that has got mad 'way back in the country and has had to come several miles over a rough road before he gets a chance to break loose and open up his mind. He was too mad to talk to, so I sent Billy along with him. Sammy is too young and small and saucy to send with a real mad man.

By and by they returned, bringing the shaft and pulley. The pulley hadn't a sign of an oil hole anywhere. I called Joe and laid down the law to him in proper shape. Wanted to know what he meant by not finishing his job. He had turned that pulley and it was his business to finish it; either had to have a set-screw, keyseat or oil hole in every pulley, and this one had neither.

Joe stood rubbing his hand over his hair and turning red and white by turns. This was new talk to him, as he was very careful and had never got called down in this shape before.

But there it was; not the first sign of an oil hole.

"I—I—I must have dreamed I put two holes in that pulley," said Joe, slowly, "but I'd have sworn I did. I mind that little lump being there." As he spoke he ran his finger-nail along where he had thought of putting the oil hole. As he did so some of the paint scraped off, and it looked white underneath. I thought it looked rather strange for iron and took out my knife and scraped around some.

It ran into some putty and the mystery was solved. That smart painter, or his helper (each denied it) had very neatly puttied up both oil holes.

I tried to think over all the work they had done and wondered how much more such work was among it. There hasn't any more come back yet; but I have a green boy do our painting now, and I am going some on the plan "Watch everybody as though no one knew anything and everyone is trying to do things wrong."

Joe felt so much relieved to find he had not overlooked part of his work that he readily accepted the olive branch I held out to him, and he soon had the shaft turned down and the pulley bored out and babbitted to the shaft. My friend, who owned the pulley, was in a good humor by this time and wanted to pay for the repairs. This I would not allow, as it was our fault. He shook me heartily by the hand at parting, and has been a regular customer ever since, and we often laugh together over the painter's job.

W. OSBORNE.

Condenser Air Pumps.

BY W. H. BOOTH.

There is a limit to the degree of vacuum obtainable by an air pump, and this limit is fixed by the proportions of the pump. We may allow a pressure of air in the condenser one-fourteenth of an atmosphere. This means that each cubic inch of free air that gets into the boiler with the feed water will occupy 14 cubic inches in the condenser, and it is in this bulky condition that it is dealt with by the air pump. The air pump acts by the formation of a very perfect vacuum between the bucket and the discharge valve. The bucket is, we will say, moving vertically and is covered with water, so that as the bucket descends it leaves a space behind it that is absolutely vacuous, except for the presence of water vapor at a pressure corresponding with the temperature. Into this space the air from the condenser rushes, and for each 1 inch of free air the air-pump bucket must move through a volume of 14 cubic inches in order to preserve a vacuum as low as one-fourteenth of an atmosphere. If a vacuum of 14 pounds is required and the barometer stands at 14½ pounds, the ratio of volumes is 28 : 29, and the air-pump capacity must be twenty-nine times the volume of the free air. The capacity of the condenser is not of any very serious moment. With a large condenser a longer time is required to pump up the maximum possible vacuum; but this, when secured, will be steady. A small condenser is very soon pumped out, but the vacuum in it is soon vitiated by small amounts of air coming over in excess of the ordinary and regular amounts. If the clearance space above the bucket is not wholly occupied by water, but instead it contains air when it begins its return stroke, this air will of course be at atmospheric pressure and will expand and reduce the intensity of the vacuum former above the bucket, and a less volume will be drawn in from the condenser, while at the same time the condenser vacuum can never be reduced so low as when the bucket begins its down stroke free of air.

A form of pump is now made in which the bucket is solid—that is, it has no passages through it.* Below, it is brought to an obtuse cone. As the bucket descends, the cone strikes the water that collects below in the bottom of the casing and causes it to travel up an annular curved passage and pass through ports in the barrel of the pump that are opened by the upper edge of the bucket as it descends below the port, just as the cone strikes the water below. Thus the bucket of this pump descends with a high vacuum above it, and into this the air and water rush and are at once imprisoned as the bucket rises, and are then forced out through the delivery valves. These are the only valves about the pump, for the bucket really performs all the duty of the foot valve. There is one objection to this style of pump, and that is, the difficulty of starting them, for when there is no vacuum in the condenser, the bucket must be forced down against the pressure in the condenser, its upper side being of course in vacuo. When once the vacuum has been established the difference of pressure above and below the bucket is but small, except for a short distance before the discharge point, when the pressure above the bucket gradually attains that of the atmosphere, which it attains just when it begins to lift the discharge valves. This air pump may be run at a high speed, and is so run in independent condensing plants. Needless to say, an independent air pump should be run some time before the main engine is started and a vacuum of at least 20 inches be pumped up. On the question of vacuum too much stress cannot be laid. I have known condensing plants run month after month with the vacuum steadily diminishing, and no particular worry appearing to disturb anyone responsible, until finally it touched as low as 15 or 16 inches. All this could be avoided if an inspection were made; for which purpose a candle-flame is as efficient a searcher out of an air inlet leak as it is of a gas outlet leak, but the one use

*This pump was illustrated in our issue of September 10, 1896—ED.

is as safe as the other is unsafe. Attention to the small leakages discovered is surprising in the results obtained in increased vacuum.

Assuming that 45 pounds per square inch of piston is a reasonable mean pressure at which to work, it is evident that the proportion due to vacuum, say 13 pounds, is an important item. If the 13 pounds become 10 pounds, there is a loss of 3 pounds, or practically 7 per cent. In electrical work the mean forward pressure of an engine does not approach 45 pounds, because the factor of load is so poor, and in such a case the constant 13 pounds of vacuum assumes an even greater importance.

When a new plant is erected it is quite usual for the vacuum obtained to be poor at the start. This should not be. In the first place, the exhaust pipes ought to be tested by blank flanging their ends and pumping air into them when immersed over head in water. When erected they should be tested before coupling to the engine, and when the plant is in working order the vacuum should be at least 13 pounds, and should remain so for a long time. Electrical engineers seem to think it a fine thing if only half the vacuum leaks away in five minutes, forgetting that this means overloading the air pump and compelling it to pump up its vacuum over and over again while at work. Having once known a 14-pound vacuum to maintain itself for an hour, this naturally forms a high-level datum line of performance, below which any other performance appears unsatisfactory. In nine cases out of ten a poor vacuum is entirely due to causes easily to be remedied. The use of high-pressure steam has had much to do with the carelessness of the modern engineer. If the vacuum fails, away they run to the atmospheric valve, holding this open the rest of the day, it may be. In the old days when the engine only used steam in order that a vacuum might be formed, the failure of the vacuum would shut down a factory. This latter-day carelessness is largely responsible for the very poor results that are secured with all the expense and complication of high pressures. There is to-day a much higher grade of ignorance in steam engineering than at any time within my recollection. The ignorance of to-day is that which, not knowing things itself, denies the probability of their existence, and I have known it to extend to a denial of the benefit of condensing working where the water for that purpose had to be paid for whether used or not, and where the average load on the steam plant did not exceed 30 per cent. of its economical load—in fact, where the vacuum would have given half the mean pressure. The worst of this ignorance is that it is unteachable, and those who try to teach are looked on as victims of mistaken enthusiam when they do but point out the simplest facts. "I have piped unto you and ye would not dance" was written many years ago, and is of singularly appropriate meaning to-day. If it were not that the engineers of Lancashire are too apt to measure the economy of an engine by its fuel consumption per indicated horse-power, they would come very near perfection in their practice. This is because so many of the men who pay for the coal do themselves understand something of steam engineering. The men who direct other branches of industry do not possess this knowledge, and thus it is we may find 2 cents per unit paid for fuel for each unit of energy produced electrically, whereas 1 cent would serve.

Letters from Practical Men

Teachers for Manual Training Schools.

Editor American Machinist:

I can agree with Mr. Stanwood in his statement that there is many a school in this country where the shop practice is of such a character as to excite the derision of even a second-grade mechanic. But I desire to ask this rather impertinent question, Can we expect it to be better when the salaries offered to instructors in this branch are on the average hardly as high as those which can be obtained by a second-grade, poorly-educated machinist?

I have never taken the trouble to investigate the question of the salaries offered to manual-training instructors in the so-called strictly manual-training schools of this country. It is probable, however, that their average will fall below the average of the salaries offered to instructors in manual training in our State universities. Leaving out of consideration the few heads of departments, professors of mechanical practice, the salaries for this class of instructors will probably range between $600 and $1,000 a year, the average probably being between $700 and $800. This, it will be seen, is not far from the yearly earnings of the mechanic, who receives from $2.50 to $2.75 per day, which is below the wages of our best mechanics who have only a common school education. Is it reasonable to expect that first-class men will be drawn to these positions when such conditions as to salary exist? I am glad there are a few exceptions to these salaries. There are also some exceptionally good men giving instruction in manual training for these salaries. But I believe for the most part, and I can speak for some of these, they are merely accepting these salaries for a short time to be so situated that they can take advanced work in our universities. The salary in their cases, it will be seen, is really higher than the payroll alone would indicate.

The instructor in manual training should have the same number of years' schooling as the instructor in Latin, Greek or mathematics, and besides this should have at least four years of practical training. In setting the salaries for these two men, according to present conditions, this extra four years of practical training will, however, count for nothing, and the difference if anything, would be very probably found in favor of the teacher in pure book learning.

There are, I believe, in this country a great many men who are thoroughly competent and who would be glad to accept positions with the manual-training schools if the financial conditions were such that they could afford to do so. The manual-training schools need just such men as are wanted by the best class of manufacturing establishments. They are thus brought face to face with competition in the labor market to a greater extent than most other educational enterprises. And until they are willing and able to meet this competition and raise the salaries of manual-training instructors considerably above those of the average teacher, the commercial enterprises of the country will continue to take the pick of these men whether they be few or many.

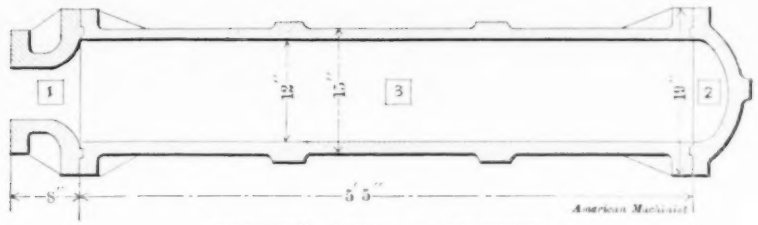
R. W. Hargrave,
Instructor in Mechanical Practice, University of Wisconsin.

The Pattern Work and Molding for a Single Casting.

Editor American Machinist:

The sketch of the "air vessel" was handed in as here shown, by the engineer, who required a set of castings before the holidays. The time in which to prepare the patterns and to cast the three pieces was very short. Only one clear day remained (as it was already three o'clock in the afternoon when we received the order) before we closed for ten days, and the job would go elsewhere if we could not cast it next day. Of course, the *casting* of the job the next day did not present any difficulties at all; it was the preparation of the pattern which seemed likely to give trouble, as none of our standard patterns seemed likely to be of service, the strengths and size being somewhat unusual. However, "where there's a will there's a way," and as the method employed turned out very well, I propose to give a short description of the preparing of the pattern and the molding of this "air vessel."

The first piece, marked 1 on the section, was molded as follows: A pulley rim of two or three inches greater diameter than the flange is first bedded into the floor and leveled, the top edge of the rim being the same hight as the floor. A seven-inch tin core box is set in the center of the rim and a wooden print is inserted into the top of the core box. The print has a hole drilled into its center in which works a nail driven into the strickle center. Fig. 1 shows a section of the mold, sweep *A* being first used. After working the first sweep around, parting sand is sleeked on to the upright portions and the eight ribs



ENGINEER'S SKETCH OF AIR VESSEL.

are set. The middle part is next rammed up and the strickle *C* is used to form the top flange. The middle part is now lifted off and the sweep *B* is used. After working it around, the tin core box is withdrawn and the space occupied by the bottom of the box is made up. The mold is now finished and closed, as shown in Fig. 2. The only patterns made for the piece were the three sweeps, which did not take more than an hour. The casting for piece No. 2 is molded in somewhat the same manner as the previous piece, but only two strickles are used. The sweep *A*, on Fig. 3, being first worked around, the outside of the sweep working on the flask edge and the center on a wooden plug set central and at the hight required by leveling off the top of the sweep. The top part of the flask is rammed up on the bed formed by the sweep *A*; then the top is lifted off and the sweep *B* is worked round. Fig. 4 shows a section of the mold complete. The time occupied in preparing the pattern in this instance was similar to that of the first one, only the two sweeps being required.

The center casting No. 3 presents no unusual features in regard to molding, but as the sizes and strengths were out of the ordinary run of pipes we again had to have recourse to the sweep. A pattern which we had was first used. Fig. 5 shows a plan of the mold with the body of the pattern drawn and the sweep set for working out the necks of the flanges. As will be seen on the plan, the body of the pipe is about one inch less in diameter than required, as also the flanges are half-inch too thin. The sweep shown, however, overcomes this difficulty very nicely, care being taken that no gaggers are in the way of the sweep on the top portion of the mold. The only new pattern work on this piece is the sweep.

By using the methods described we were able to make the castings in the time specified, and also do the work in an economical manner. The castings turned out all that could be desired.

GEO. BUCHANAN.

Aresham, North Wales.

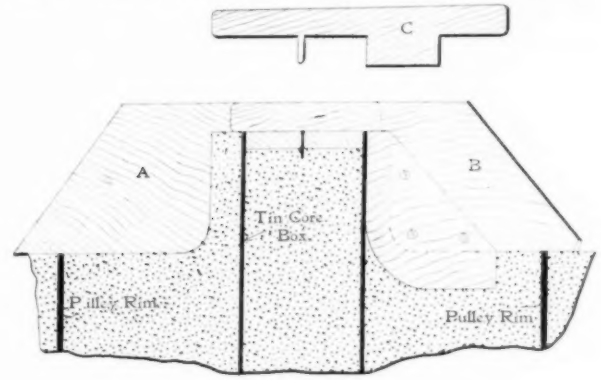


Fig. 1

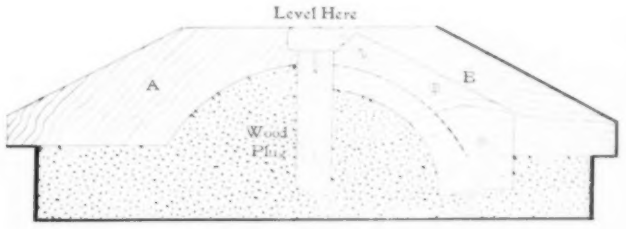


Fig. 2

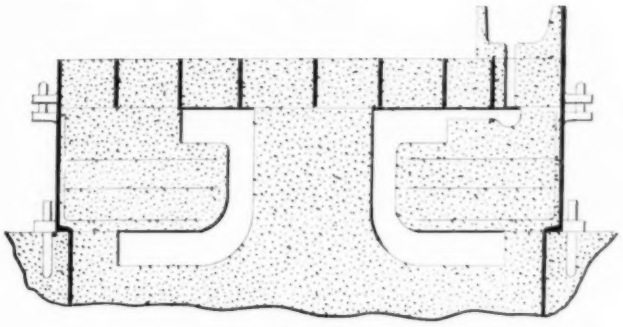


Fig. 3

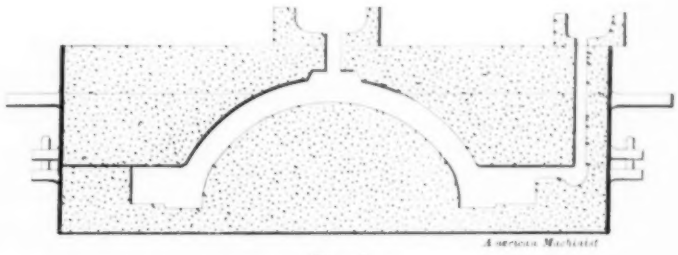


Fig. 4

EMERGENCY MOLDING WITH SWEEPS.

A Friction Geneva Stop Gear.

Editor American Machinist:

While in many mechanisms a positive motion of the various shafts and other moving parts is required, yet in some the motion given certain members is not necessarily a fixed amount, variations within certain limits being permissible.

It is assumed that the reader is familiar with the Geneva stop. Suffice it to say that it is a device for arresting the movement of a shaft after a certain number of turns have been made. It is most frequently employed in watch and clock movements, although the familiar star feed is only a modification of it.

In cases where a comparatively heavy mass is to be set in motion, or where the ratio of speed is not required to be exact, the friction device described here will fully answer the purpose, and have the advantage of being noiseless. As the amount of slip will be practically uniform under con-

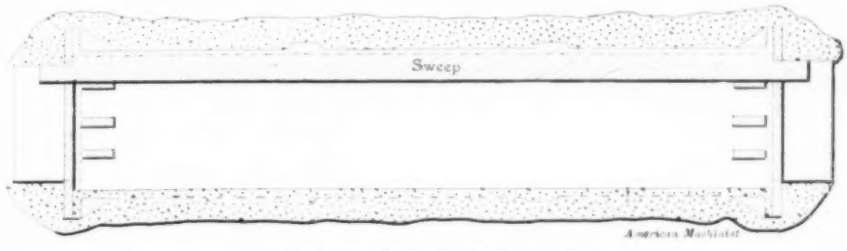


FIG. 5. PLAN OF MOLD FOR PIPE.

stant conditions and through fairly long periods, the possible applications of this friction may be more numerous than is apparent at first glance.

Fig. 1 shows the device with one friction block or tooth, if we may use that term. It will be noticed that if we employ a friction block A, having a width (measured on the pitch line) of, say, 1 inch, and if we make the circumference of the driven disk C 12 inches, for instance, we have a ratio of gearing of 12 to 1, assuming the loss by slipping to be negligible. Should

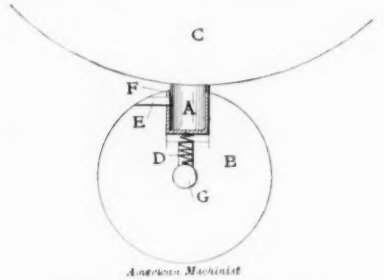


FIG. 1. FRICTION GENEVA STOP.

it be desired to work closer we can readily determine the amount of slip taking place by experiment and make the face of our friction tooth wider by a quantity which corresponds to the slip, and in this way produce a ratio of transmission very nearly approaching that of positive gearing.

A coiled spring *D* applies pressure between *A* and *C*, a stop *E*, engaging slot *F*, being provided to prevent the block from leaving the cylinder *B*, through the action of the spring, of gravity (when tooth is passing the lower center), or of centrifu-

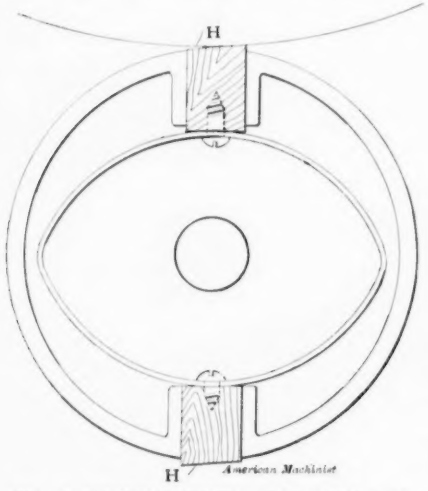


FIG. 2. FRICTION GENEVA STOP WITH TWO TEETH.

gal force. Means for adjusting the spring pressure can be readily introduced by making shaft *G* hollow and inserting a rod with a wedge against the spring, the wedge of course traveling in a slot in the tube or hollow shaft.

In Fig. 2 is shown a driving wheel with two friction blocks, pressed outward by a flat spring common to both, so that the pressure will be exactly equal on either block. By shaping the face of the friction tooth so as to increase the pressure between it and the driven disk gradually, the second shaft with its load can be set in motion gently, which will in most cases be preferable to a sudden start. At *H* is shown the manner of shaping the tooth so as to produce this result.

Coil springs may obviously be used in place of the elliptic spring of Fig. 2, and more blocks may be used if desired.

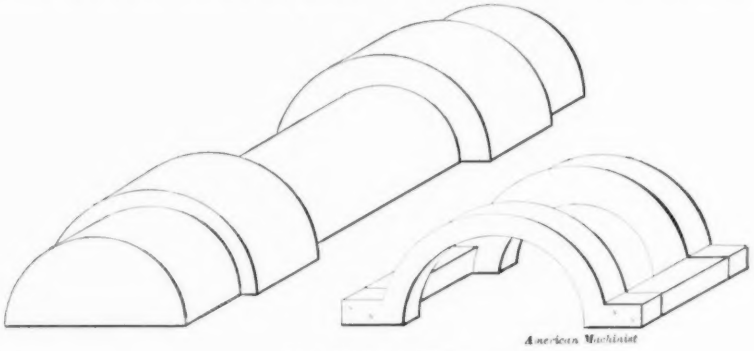
GEO. M. MEYER.

Enlarging a Core.

Editor American Machinist:

The sketch shows a dry sand core made in a half-round box. It was necessary to enlarge the parts marked *A A* an inch in diameter, in order to suit a special job. The box being a stock one, we were not allowed to cut it, so the device shown at the right was made and used to enlarge the core where required.

The ends of this frame were made to fit over the smaller parts of the core. The outside diameter of the arches was the enlarged size, and the distance between them was the length of the parts marked *A* to be enlarged. This frame was placed in position on the core while it was green.



ENLARGING A CORE.

The part of the core between the arches was then built up and strickled off to size. It will be noticed that the middle portion of the core is smaller than the ends, while both of the portions marked *A* were of the same diameter. The frame therefore was reversed or turned halfway around when changed from one end of the core to the other. As it stands it is right for the near end of the core.

This device, I suppose, was used by Noah's patternmaker on the first marine work that we have record of. HOBO.

Technical Publications.

"Up-to-Date Air-Brake Catechism." By R. H. Blackall. Twelfth edition. 254 5x7¼-inch pages, with 52 illustrations. N. W. Henley & Co., New York. Price, $1.50.

The appearance of the twelfth edition of any technical book within but little more than two years is sufficient testimony to its value. This book aims to describe the latest devices which have been incorporated in and added to the air-brake system. There are thus included chapters on the whistle signal, the pneumatic bell-ringer and the pneumatic sander. The present edition contains several new chapters.

"Hints on Painting Structural Steel and Notes on Prominent Paint Materials: A Hand-Book for Paint Users." By Houston Lowe. Published by the Press of United Brethren Publishing House, Dayton, Ohio. Price, 50 cents.

This is a paper-bound book which tells a great deal in very plain language regarding the various causes of failure of the various oils and pigments used in painting metallic structures, and also gives a good deal of information regarding the various ways of going wrong in doing such work. It may be studied with profit, we think, by most anyone interested in such matters.

"The Design and Construction of Oil Engines." By A. H. Goldingham. 196 5x7½-inch pages, with 95 illustrations. Spon & Chamberlain, New York.

This is a special treatise on engines using heavy kerosene having a specific gravity of .78 to .85 and a flashing point of 75 to 300 degrees Fahr. It is, we believe, the first book devoted to this class of engine as distinguished from gas and gasoline engines. It treats of the design, testing, repair and use of such engines, and describes the leading engines on the market. The use of the indicator in this special field is quite fully covered, and several useful tables are included.

"The Construction of a Gasoline Motor Vehicle." 120 6½x9½-inch pages, with 167 illustrations. The Motor Age, New York and Chicago.

This pamphlet gives very complete working drawings and a detailed description of the construction of a motor carriage. It is intended for the guidance of mechanics and amateurs of the more capable sort in constructing a carriage for their own use. The motor is a two-cylinder engine, the cylinders being fixed to the opposite ends of a crank case and connected to cranks set opposite each other to give an impulse to every revolution with perfect balance of the reciprocating parts. The pamphlet is accompanied with a full set of blueprints, the combination being

sold at $7.50. We judge the price of the book alone to be $1.

"Questions and Answers from the 'American Machinist.'" Compiled by Frank Richards. Cloth, 403 5x7-inch pages. American Machinist Press. $1.50.

There is little need to tell readers of the "American Machinist" much about this book. During its career of over twenty-three years the paper has answered many thousands of questions pertaining to machine design and construction. Over a thousand of those that seemed to the compiler to be most likely to be useful and of permanent value have been incorporated in this book. It replies to many questions that our correspondence shows mechanics are continually wanting answers to and we believe will be useful to those who seek information within our field. The questions and answers are classified according to the subjects to which they relate for convenience of reference.

"Bridge Construction;" a handbook for use in designing of steel (iron), wood and stone bridges, and for use in the classroom. By Privy Councillor Prof. E. Haeseler, of the Technical High School at Brunswick, Germany. Part I. Steel (Iron) Bridges. Fourth Section, first half. Published by Fried. Vieweg & Son, of Brunswick.

Nothing but praise can be given to the paper, printing and the illustrations of this, another of their superb technical books, so well known the world over. The subject treated is precisely what its title indicates. The discussion and calculation of stress sheets is entirely omitted, and the author's attention is devoted to illustration, design and calculation of details of bridges of all types. It should be of great value to American bridge engineers, American truss bridges being fully described and illustrated. Besides very numerous text illustrations, a folding atlas of full and double-page illustrations is bound in with the book in such manner that full-page illustrations lie open, flat, beyond the edges of the pages containing reading matter.

"Science and Technology Annual," 1899-1900. 72 7x10-inch pages, with illustrations and diagrams. The Pratt Institute, Brooklyn.

This publication is a record of experimental work by the students of the department of science and technology of the Pratt Institute. Some papers prepared by the students for their technical asociations are also included. Among the series of experiments recorded is one on the change of the electrical resistance of copper wire through change of temperature; one on the holding power of a magnetic chuck; one on the effect of temperature on tensile strength and elasticity, the temperature due to liquid air being included in the experiments; one on the effect of repeated stress on the tensile strength and elasticity of annealed iron wire, and others of this nature and quality. The courses of study at Pratt Institute cover but two years, while the scholastic acquirements of the new students, as shown by the entrance requirements, are meagre. That such work can be carried out by such students is certainly highly creditable to the work of the school.

"Monopolies and the People." By Charles Whiting Baker, C. E., editor of "Engineering News." Third edition, revised and enlarged. 368 5x7½-inch pages; cloth. G. P. Putnam's Sons, New York and London.

The first edition of this book appeared ten years ago, and it speaks well for the interest that intelligent people are taking in the matters it discusses, to find that now a new and enlarged edition is called for. The author certainly can congratulate himself upon the fact that very many of the statements made by him ten years ago, and which at that time did not seem to be so plainly evident as they might have been, have, by the experience of the intervening years, been demonstrated to be correct. The book is divided into three parts, of which the first is devoted to an "Investigation of the Limitation of Competition in Modern Industry: Its Causes and Effects"; the second reviews "A Decade of Progress Toward the Death of Competition," and the third is devoted to a review of "Evils Wrought by Recent Economic Changes," and to the making of "practical suggestions for their remedy." In treating of "natural monopolies" the author gives, as probably the most notable example of its workings, the operations of the copper syndicate (which were very prominent at the time the book was written), and points out that it failed to place the world at its mercy, so far as the copper supply is concerned, only because it neglected certain precautions, rather than because it is intrinsically impossible to bring about such a condition. Of far greater importance to us are declared to be the monopolies which control the price of coal, and particulars are given regarding the anthracite coal monopoly which, especially now, so soon after the great coal miners' strike, make "mighty interesting reading." The necessarily monopolistic character of railroad business is pointed out and the necessity of agreements as to rates, etc., affirmed, in order to obviate utterly ruinous competition, and that therefore, and for other reasons as well, there is no hope that competition can ever operate to protect the rights of the public. The author calls attention to the fact that the private owner of the only pass over a high chain of mountains separating two populous and wealthy sections of the country, could, if he retained his private title, derive a princely income by simply permitting, on his own terms, passengers and goods to pass through it. But by "right of eminent domain" a road could be built through the pass, and he would receive only the value of his land occupied by the road; and the author argues, with what seems to be irrefutable logic, that the private corporation which by exercise of the power of "eminent domain" has acquired the land and the control of traffic through the pass, has no greater natural or ethical right to charge what it pleases without reference to the rights of the people than the original owner would have had. When the subject of other monopolies is taken up, however, our author is not quite so convincing in all that he says. For instance, in speaking of monopolies in the labor market, he says: "When the rate [of wages], which, without prejudice, we call the natural rate, is at $3 per day, suppose the men belonging to the trade form a union and resolve to charge $5 a day for their work. Then it is very evident that the cost of building is increased, and everyone has to pay more for construction and ask a higher rent to repay himself afterward." Now, a very little examination of the matter will show that values of real estate are based upon the income that can be derived from them. If a company proposes to erect an office building in New York, for instance, it determines as nearly as possible what rentals can be obtained for the building, and then the cost of the land and building combined must come within a figure which will make the rentals obtainable a fair return upon the investment; and it is a fact familiar to all who have investigated the matter, that improvements in building con-truction by which costs per square foot of floor area have been reduced have not lowered rents, but have increased land values in the region within which such buildings are erected. That is to say, cheaper buildings have enabled builders to pay more for land and still get a fair return upon their capital, and they have paid it, and are paying it. It is clear that a lowering of wages paid to workmen in the building trades would have the same effect, and *per contra* that raising them would, by so much as it increased the cost of erecting buildings, lower or hold in check the rise of land values. Our author unqualifiedly approves of labor organizations, however, and among the other good things that can be accomplished by them, speaks of their power to abate the practice of brutally treating workmen by employers, foremen or overseers, and remarks, "Bodily violence is no longer permitted by law, but too often the curses and insults which are heaped on men with no due cause are a violence which is more severe to many a man than actual cuffs and kicks. No man is truly free if he is not secure in his right to immunity from personal insult as well as from bodily violence." It is declared that "Monopolies of every sort are an inevitable result from certain conditions of modern civilization," and instead of attempting to destroy them, the plan of regulation with

public rights in view is advocated. For instance, the author states his proposition with regard to railroads, and says the same principles are applicable to many other monopolies: (1) Government protection to the owners of fixed capital, so that the public may obtain the use of it at the lowest possible rate of interest; (2) The operation of monopolies by corporations rather than by the government, thus securing the increased efficiency of private over official management; (3) securing to the people at large the benefit of the monopoly by basing the prices for its product on the cost of service; (4) but leaving a suitable incentive for the company's managers to maintain economy and efficiency in its operations; (5) government representation in the directorate controlling the ordinary affairs of the company. As perhaps the strongest argument in favor of such governmental participation in the management of monopolistic industries, it is claimed that by the formation of such monopolies, those who form them "elect to become necessary servants of the public—far more necessary, indeed, than the inn-keeper or the stage-coach driver—and ought they not therefore to be placed under similar legal restrictions? To sum up, the chief features of the plan proposed for the control of monopolies in manufacture and trade are as follow: Make contracts to restrict competition legal and binding, instead of illegal and void as now. But provide that every such contract shall be filed for public inspection; that prices charged by the combination shall be public, stable and absolutely unvarying to all; that the affairs of the combination shall be managed according to a consistent and stringent corporation law, and that an annual report of the operations of the combination be made to a public commission." This will be called radical and revolutionary by some, and our author recognizes that fact, but he says, "No candid man who will make a thorough study of the present status of monopoly and of the attempts to control it can be conservative." Besides showing the results of very considerable study of economic and social questions, the book indicates that its author has his share of human sympathies and that he does not let his search for economic truth blind him to the rights of men to live under decent conditions. But his feeling for men and regard for their rights are not confined to any one class of men, but include all, capitalists as well as workers, and we think that no thoughtful and candid man can read the book without being impressed by the importance of taking some action to avert the present unsatisfactory tendencies.

Inhabited Safety Valves.

The "Locomotive," published by the Hartford Steam Boiler Inspection & Insurance Company, says in a recent issue: "Overalls, monkey-wrenches, hammers, loose rivets and all sorts of things are sometimes found in boilers by our inspectors, as we have frequently related in 'The Locomotive.' It may be mentioned, too, that pop safety valves also frequently serve as receptacles for unexpected things, though in this case the foreign articles are usually deposited there by our friends of the world of fur and feathers. Pop valves, in fact, are growing to be quite fashionable places for birds' nests, and it is not uncommon to find that the English sparrow has utilized such a valve as a hatchery and nursery. When a number of boilers are always run together as a single battery, it usually happens that there are slight differences in the blowing points of the different valves, so that under ordinary circumstances only one or two of the valves blow, relief enough being obtained in this way to keep the pressure below the blowing points of the others. An enterprising sparrow may then rear her brood in a lazy way, by building her nest where the temperature is just right. All she has to do then is to turn the eggs from day to day, and the rest of the time she can go to picnics or attend circuses or grand opera, according to her taste, with the full knowledge that the proper temperature is being maintained at home. She has, in fact, quarters that are up to date. They are heated by steam, and the boiler is cared for by the janitor, the engineer, who is paid for this service by the otherwise soulless corporation that owns her flat.

"Occasionally, however, she and her little family are evicted—literally 'fired out.' We hear, in the larger world, of the janitor giving a tenant 'a good blowing up,' and this is what happens, from time to time, to our little bird families, through no fault of their own. One of the inspectors from the Hartford office of this company recently had a pop valve blown in his presence, so that he might be satisfied that it was in good condition. A straight escape pipe led from the valve out through the side of the building, and when the valve blew, out through this pipe came nests and other things galore, and immediately there were flats to rent in that valve and pipe.

"Squirrels, too, are coming to regard pop valves with increasing favor, both as nesting places and as safe-deposit vaults for the storage of nuts. A few days ago one of the Hartford Company's inspectors found a pop valve that was filled almost solid full of hickory nuts by some industrious squirrel. It is not likely that these nuts would have prevented the valve from blowing, and yet, when considered from an engineering standpoint, they could not be regarded as an improvement to it. A pop valve loaded with hickory nuts and provided with a straight, horizontal escape pipe, would, when it blew, be likely to make the neighbors think the Spanish war was still with us."

The Song of Steam.

The song of the ship of the bellying sail
  Has oft been sung before;
How she stanchly rode the shrieking gale
  'Mid the crashing breakers' roar.
The praise of the sturdy coach of mail
  Has proved a stirring theme,
As it recklessly rushed o'er hill and dale
  Drawn by its foam-flecked team.

But the energy locked in the diamond black
  Since first the world began,
Has yielded its prison power back
  To work the will of man;
And the liner swift ploughs the mighty main
  Where erst the white wings flew,
And the steed of steel skims the pathless plain
  Which the mail coach never knew.

The lathe, the drill, the press, the loom,
  The winch, the walking beam,
The many power plants that bloom,
  Attest the might of steam;
But the greatest good it has ever borne—
  There isn't a doubt of that—
Is when in the cool November morn
  It radiates through your flat.

M. W. POOL, in Troy "Standard."

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(7) Albion, Atlanta, Ga., says: It seems to be the current practice in building air compressors, to make the stroke short when compared with the diameter. For instance, it is a very common thing to see an air compressor with a 12-inch bore and a 12, 13 or even 14-inch stroke, and in some cases the stroke is actually shorter than the bore. On the contrary, with ammonia machines the stroke is frequently twice the bore of the cylinder. It would seem to the writer that, laying aside the question of shop cost, an air compressor built in the proportion that the ammonia pumps are ordinarily made, would be preferable, for the reason that either in the long or short stroke you would have the same amount of clearance between the piston head and cylinder head; if one cylinder was twice the length of the other, the loss by re-expansion in the long cylinder would be about one-half what it would be in the short cylinder in compressing the same amount of free air. Not being particularly well versed in the subject, I would like to inquire if the practice of making air compressors of such relatively short strokes is good practice or not. A.—Your reasoning is sound, although there is not so much to be gained from the reduced percentage of clearance due to the longer stroke in an air compressor as in an ice machine, because of the pressure being lower. We consider that from all points of view, including that of shop cost, many compressors have too short strokes. In addition to the clearance argument, it is to be considered that with poppet valves, which are in nearly universal use for the discharge at least, the limiting speed is set by the valves. A machine of a given bore of cylinder, and hence weight of valves, can be run at practically the same number of revolutions, regardless of its length of stroke—within reasonable limits of course. An increase in the stroke therefore increases the piston displacement in the same proportion, while it does not increase the

cost in the same proportion. Considering two machines of the same bore but of different strokes, running at the same piston speed, it is clear that the valves of the short-stroke machine will strike their seats more times and probably as violently as in the longer machine and that the wear will be correspondingly greater.

Practical Mathematics.

Editor American Machinist:

I was very much interested in the editorial remarks in a recent number of the "American Machinist," based upon the pamphlet of Prof. John Perry on "Practical Mathematics." Personally, I have very profound convictions upon the intimacy which should exist between the mathematics taught in an engineering course and other engineering subjects. From the experience of both myself and many friends, I fear that this intimate relation is not even thought of in a good many of our best universities. The mathematics of the class studying that subject is as different as it possibly can be from the mathematics which a student has to learn to use in his real engineering work. This is true not only of the scope of study, but of its method of presentation as well. It is presented so as to be of as little use to a man studying engineering as the study of the German language (as commonly taught) is to the man who wants to read technical works written in that tongue. I have even been told seriously by a university professor of mathematics that his was not a practical subject at all and could not be made practical.

I was somewhat surprised, however, to find you championing so strongly the correspondence schools as the ones where mathematics and other studies are put into rational relation. I feel that you are mistaken here, and I base my opinion upon an experience of several years in contact with students in, and graduates from, the best of these schools. I thoroughly admire many of the methods used by the correspondence schools, and I think that the technical schools and colleges have some things to learn from them; but I find that they have gone to the extreme of making mathematics so practical that it is reduced largely to empiricism. Their work is exceedingly superficial, and while the students learn to work problems, they work them because "that's the rule" given in the instruction paper.

Empiricism has its place in engineering, to be sure, but when sound and well-understood principles can explain the whys and wherefores of practical problems, it is certainly a pity to treat these matters as though they were settled simply by engineering practice.

Here at Drexel Institute our work for some years has been to make mathematics, physics, mechanical and electrical engineering all so correlate and supplement each other as to combine them into one organized consecutive line of study. Mathematics is so taught as to be the basis of all science and engineering work, and as the various mathematical subjects are developed, not according to a strict established order, by the way, all the related studies are built up along with it, each bending to supplement the others, so as to meet their requirements as well as to have its own proper growth. We expect, as the years go on, to make this relationship a still closer one.

I write thus to show you that there are places in our own country where the term practical mathematics means something; where without sacrificing any of the scope of engineering study or any of the helpful higher mathematics, all is wrought out together and with one aim in view—the training of *competent* engineers.

ARTHUR J. ROWLAND.

Drexel Institute, Philadelphia.

[Our remarks regarding the correspondence schools were not intended as a whole-ale endorsement of their methods. While admiring their skill in adapting means to ends, we are, at the same time, well aware of their shortcomings. While there is much in their mathematical work that may be fairly criticised, nevertheless, so far as we know, and as we said in our previous article, "the nearest approach to the *spirit* of Professor Perry's methods that we have in this country is found in the work of the correspondence schools." We still think that the general proposition will hold, though it is quite possible that in a few cases, like the Drexel Institute, for example, other schools than those of the correspondence class are beginning to realize their students' real needs in mathematical work.—Ed.]

The Selden Patent on Automobiles, and the Dieterich Gear.

Editor American Machinist:

I have read with pleasure the editorial comment in your esteemed paper No. 4 about my article, "Horseless Age," January 17, but find that the latter seemingly was understood by you as dealing only with the Dieterich gear in reference to the Selden patent.

I would like to say that this was not my intention at all, as I pointed only to a certain class of transmission devices which enable a gradual change of speed to zero.

In my conversation with you last week, I mentioned that it is from a practical point of view, leaving aside above-stated theory, not even necessary to reduce to zero but only to a very low speed—one mile per hour would probably be sufficient for practical purposes.

Devices filling these conditions are numerous in the friction and movable-crank-pin class; it is therefore not absolutely necessary to employ the Dieterich gear in a combination with an internal combustion motor and a carriage body to have, in regard to the Selden patent, not an invading but principally new construction.

But I certainly claim that the Dieterich gear is the only one combining rotary motion of all parts, positive transmission of power, gradual change, and, if desired, even automatic action.

I hope this explanation will help your readers of the "American Machinist" to rightly interpret my ideas about manufacturing gasoline automobiles legally outside the scope of the Selden patent.

Although personally corroborated in my point of view in this matter by some of the best prosecuting patent attorneys, I should be very pleased to see in the columns of your esteemed paper comments of your readers about this question, which seems to be an interesting one.

L. M. DIETERICH.

The Avery Engine in a Saw Mill.

Editor American Machinist:

In my communication [printed at page 47] relative to Mr. Avery's rotary steam engine, the number of saws that I meant to say the twelve boilers would have run was six instead of twelve.

JOHN W. SUTTON.

"The American Danger."

Germany has found out, or thinks she has, that it is the United States which has hoodooed her prosperity. The Essen Chamber of Commerce admitted in its recent annual report that the change in Germany's industrial situation came from America. In a report from Berlin by Consul-General Frank H. Mason is quoted a long editorial article from the "Hamburger Fremdenblatt," of December 8, upon "The American Danger." It is apropos to the annual report of the Secretary of the United States Treasury, which shows a brilliant situation in revenues, commerce and finance, the United States being now in possession of one-fifth of the entire gold and silver money of the civilized world. In its comments upon the elements of this condition the journal says in part:

"The steel manufactories of the United States, which two decades ago were in their infancy, to-day control the markets of the world, dictate either directly or indirectly the prices of iron and steel in all countries, and, partly through the richness of their supply of iron ores and coal, partly by the use of labor-saving machinery and skillful, effective means of transportation, have attained a position to not only compete with the older iron-and-steel producing countries, but even to profitably export their products to England.

"American tools, especially hatchets, axes, files, saws, boring implements, etc., enjoy by reason of their excellent quality the best reputation, and, in spite of their higher price, stand above competition in nearly the whole world. Also in sewing machines, bicycles, and agricultural im-

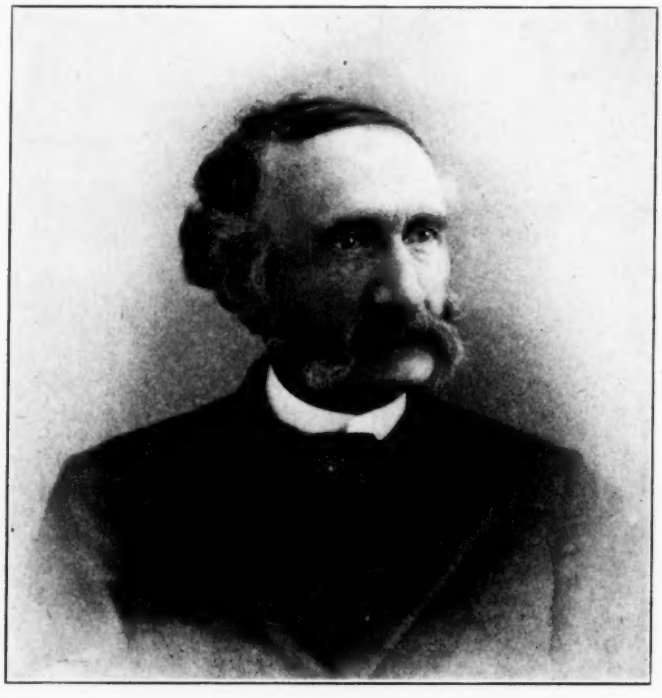
plements of every kind, the United States has begun to drive England and Germany from the world's markets, especially that of Russia.

. . . . . .

"Incidentally, it may be remarked that the typewriting machine with which this article is written, as well as the thousands —nay, hundreds of thousands—of others that are in use throughout the world, were made in America; that it stands on an American table, in an office furnished with American desks, bookcases, and chairs, which cannot be made in Europe of equal quality, so practical and convenient, for a similar price. The list of such articles apparently unimportant in themselves, but in their aggregate number and value of the highest significance, could be extended indefinitely. But it would seem more interesting and characteristic to cite the fact that an American syndicate is now planning, and has even taken the initial steps in a scheme, to take in hand the whole sleeping-car service of Europe, to improve it and make it cheaper than is now possible.

. . . . . .

"But enough of examples. Everyone who understands the existing conditions and has followed these conclusions drawn from the best sources and based upon thorough knowledge of the facts, will agree that the threatened danger from America is neither exaggerated nor painted too darkly, but is, in fact, real and serious. But the mere recognition of the peril avails nothing; what is demanded is to face it, to overcome it, or at least to minimize as far as possible its effects. We must ask ourselves whether this is still possible, and if so, what are the means, the methods, that must be employed to secure a successful result. There is but one answer to this question. We must fight Americanism with its own methods, the battle must be fought with their weapons, and wherever possible their weapons must be bettered and improved by us. Or, to speak with other and more practical words, Germany—Europe—must adopt improved and progressive methods in every department of industry; must use more and more effective machinery. Manufacturers as well as merchants must go to America, send thither their assistants and workingmen, not merely to superficially observe the methods there employed, but to study them thoroughly, to adopt them, and wherever possible to improve upon them, just as the Americans have done and are still doing in Europe."



ADNA BROWN.

Personal.

Theodore H. Miller has been engaged as superintendent of the works of the Utica Drop Forge and Tool Company, at Utica, N. Y.

Leonard Ames, who has been at the head of the Ames Iron Works, Oswego, N. Y., for twenty-five years past, has retired. The firm has recently been incorporated, as mentioned in this paper.

George H. Follows, formerly with the Westinghouse Electric and Manufacturing Company, has been appointed works manager of the Miller, DuBrul & Peters Manufacturing Company, Cincinnati, Ohio.

Hon. Charles A. Prouty, of Washington, D. C., member of the Interstate Commerce Commission, delivered an address before the engineering students of Purdue University, January 21, on "The Railroads and the People."

Henry Theobald, general manager of the National Cash Register Company, Dayton, Ohio, has resigned, and A. L. Lauver, assistant manager, will perform the duties of the general manager until a general manager has been appointed.

J. W. Peterson, for some time past associated with J. Holt Gates, of Chicago, has become connected with the Chicago office of the Northern and Stanley electrical manufacturing companies and will hereafter sell these makes of apparatus.

Charles K. Thomas has resigned as special representative of the "Railway Age," Chicago, having been appointed general sales agent of the Reliance Machine and Tool Company, of Cleveland, Ohio, manufacturers of the Morgan patent bolt cutter.

Obituary.

Adna Brown, president of the Jones & Lamson Machine Company and of the Parks & Woolson Machine Company, both of Springfield, Vt., died January 14, seventy-two years old. Mr. Brown was a native of New Hampshire and was educated in the public schools. At the age of sixteen he was apprenticed to learn the machinist's trade and became successively journeyman, foreman, superintendent and manager, and finally president of the Parks & Woolson Machine Company. His interests spread widely beyond his original business. He was largely instrumental in securing the location of the Jones & Lamson Machine Company in Springfield, and as president aided substantially in its growth and success. He was also president of several other local industries, including the Caverley-Gould shoe business and the Springfield Electric Railway Company. He had been a member of both houses of the New Hampshire Legislature and was a World's Fair Commissioner. He was easily the leading citizen of Springfield, and was very highly esteemed there and throughout the State.

Engineers Wanted.

New York State civil service examinations will be held February 16 in twenty-eight towns for various positions, including chief engineer at State departments, hospitals and institutions at a salary of $720 to $1,400 and maintenance. For further particulars and application blank, address State Civil Service Commission, Albany, N. Y.

Manufacturers.

The Cuero (Tex.) Cotton Mill is to be built at once.

Dilman Bros., Rochester, N. Y., talk of adding an ice manufacturing plant.

A site has been selected for the new Rowe Knitting Mill, in West Huntsville, Ala.

The Standard Manufacturing Company, Athens, Ga., will build a new knitting factory.

Rader C. Boyd and Henry Sleight, of Ports-

mouth, O., think of starting a new machine works.

The Dixie Furniture Company, Lexington, N. C., has received its charter and will build a plant.

The plant of the Pennsylvania Chair Company, of Towanda, Pa., was destroyed by fire recently.

The American Ice Company will establish a small ice factory at Arlington, Baltimore County, Md.

A power-house is to be built at Moorestown, N. J., for the Camden & Suburban Railway Company.

The Consolidated Cement Company, Milwaukee, Wis., is building a $75,000 plant near Whitefish Bay.

Mackenzie & Mann, Port Arthur, Ont., will build, next summer, a 1,500,000 bushel elevator, to cost $350,000.

The granite sheds of Dillon & Haley, Montpelier, Vt., were burned January 19, and valuable machinery destroyed.

A new carriage factory is to be erected at No. 19 Market street, Camden, N. J., for R. Preisendenz, of that place.

Geo. H. Leary, West Brookfield, Mass., will build a factory, in connection with which there will be a boiler-house.

The Narragansett Electric Lighting Company, Providence, R. I., will erect a transforming station at Apponaug.

The gin plant of the Dublin (Ga.) Oil Mill & Ice Company will be increased from about twenty-five to fifty bales a day.

Plans for the Madison County Spinning Mill, Huntsville, Ala., have been completed and the mill will be established at once.

It is rumored the Sweetwater (Tenn.) Woolen Mills will shortly add a cotton yarn and warp factory of about 4,000 spindles.

A $30,000 factory building will be erected for the Foster-Munger Company, Chicago, manufacturer of sashes, doors and blinds.

The Philadelphia, Doylestown & Allentown Railroad Company is having plans drawn for a power-house to be built at Perkasie, Pa.

A fire, January 20, did considerable damage in the wire-work factory of Edward Darby & Sons, 113-117 Bread street, Philadelphia, Pa.

The Delaware Button Company, which is having a plant built in Wilmington, is to start up about May 1 and employ about 400 people.

The Ark Brand Paint Company, Niagara Falls, N. Y., has been sold, and it is stated that the capacity of the plant will be increased.

It is announced that the Taylor Signal Company, Buffalo, N. Y., intends to build a foundry in which over 200 men will be employed.

The Globe Pattern Works, Indianapolis, Ind., is understood to be building a factory for wood and metal patterns. It will have a foundry.

A factory is to be erected at Schuylkill avenue and Catharine street, Philadelphia, Pa., for Henry C. Fox & Sons, manufacturers of glassware.

The Advancement Association, Beaver Dam, Wis., has decided to form a stock company to establish a malleable steel range plant in that city.

The foundry building owned by the Philadelphia Roll & Machine Company, at Twenty-third and Carpenter streets, Philadelphia, will be enlarged.

The Howard Iron Works, Buffalo, N. Y., is now making a full line of bolt-heading machinery, automatic nutters, tappers, threaders and pointers.

(Continued on next page.)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant ; see p. 22.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Mfg.plants,space,powers,land. A.Ela,Boston.

For Sale—One 4 horse-power gas engine. Box 1171, Springfield, Mass.

Wanted—Modern, 15 in. stroke keyseating machine. Address Box 69, Franklin, O.

Gasoline motor castings; best jump-spark plug made. Orswell, 34 Beach, Boston.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

Wanted—Designing and drafting, by competent mechanical draftsman. Box 255, A. M.

Would like to correspond with patentees of improvements in grinding machinery. Box 1435, Providence, R. I.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

Send for circular of the Rich Handy Drawing Outfit; it is a great time-saver. J. & G. Rich, 120 N. 6th st., Philadelphia, Pa.

Wanted—Single copies of "American Machinist" for January 13, 27, 1898. Address, giving price, Mechanical Department, Agricultural College, Michigan.

Threads and gears; easy rules to cut any thread possible to be cut in the lathe, without algebra, sent to any address for 25c. by G. W. Dixon, Spring Lake, Mich.

For Sale—Patent No. 642,822, universal dividing head for punching, drilling and gear-cutting machines, described in the "American Machinist" No. 2, 1901. Box 256, Am. Mach.

Manufacturers—Mechanical engineer has patented designs for a line of steam separators that he wishes to place on royalty with good concern. Address Box 260, Am. Mach.

Estimates on water, gas and electric meter indexes, in whole or parts; special clock movements; small tools and dies; gear work a specialty. Smith Novelty Co., 28 Commerce st., Trenton, N. J.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Rare Business Opening.—Going,well-equipped tool and die works for sale; cash consideration nominal; fullest information; excellent line of customers, being largest concerns in country; liberal terms; profitable investment for right man; apply quickly. D. T., care American Machinist.

A well-equipped machine shop and foundry, with ample water power, capacity 50 mechanics, tools suitable for engine building up to 24x24-inch or similar work, invites proposals in their line, or will consider manufacturing new specialties. Address P. O. Drawer 414, Lockport, N. Y.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

As mechanical draftsman, 3 years' experience. Address H. L. S., 7955 Hill st., Wilkingsburg, Pa.

First-class draftsman, designer and practical mechanic, technical graduate, wants to change position. Box 249, Amer. Machinist.

Many years' experience as toolmaker, designer, inventor, foreman; would change; specialties preferred. Box 248, Amer. Mach.

Draftsman, competent and reliable, with technical education, 7 years' varied experience, desires situation. Box 259, Am. Mach.

Wanted—By foundry foreman, foremanship of foundry making engine castings or general jobbing, heavy or light. Address Box 178, American Machinist.

First-class machinist and engineer, with experience in installing machinery, also a good draftsman, wishes position in drafting room. Address F. W. B., care Amer. Machinist.

Mechanical engineer, sober, reliable and competent, having had long experience in charge of men, machinery and power plants, desires a change of position. Address Box 227, American Machinist.

Position wanted by young man, 28, technical graduate, on drafting and light experimental work; specialty, electrical apparatus and small machinery; best of references. Address Box 258, American Machinist.

A general foreman wishes to make a change; can handle 200 men; first-class experience in manufacturing steam engines, air compressors, machine tools and both light and heavy general machinery. Address Box 257, Am. M.

Wanted—Position as superintendent; capable of organizing and handling a machinery plant in all its branches; am a designer of special and automatic machinery, tools, jigs, fixtures for the rapid and economical production of interchangeable work. W. H. S., American Machinist.

Help Wanted.

Wanted—Competent draftsman with experience on engines. Cole Mfg. Co., Newnan, Ga.

Wanted—First-class mechanical draftsman for Corliss engine work. Address Box 254, American Machinist.

Wanted—A thoroughly competent pump salesman; an excellent salary will be paid to the right party. Box 236, Amer. Machinist.

Wanted—A first-class draftsman, rapid and accurate, accustomed to engine work. Apply, with references, Room 1208, 120 Liberty st., New York.

Wanted—Operator for Jones & Lamson turret machine; give experience and references. The Goulds Manufacturing Company, Seneca Falls, N. Y.

Wanted—First-class draftsman, experienced in generators and motors, direct current; state age, experience and salary expected. Address Box 237, Milwaukee, Wis.

Wanted—Experienced draftsman, one familiar with hoisting machinery preferred; state salary, experience and where last employed. Address "Philadelphia," care Amer. Mach.

(Continued on next page.)

Wanted Agency.

Party long established in business, with office on ground floor in machinery district New York city, would like to communicate with manufacturers of a line of machinery or tools, with a view of taking agency for same. Address "Agency," care American Machinist, 218 William st., New York.

VALUABLE BOOKS.

Mechanical Movements, Powers, Devices and Appliances,
By Gardner D. Hiscox. **Price, $3.00**

Horseless Vehicles, Automobiles and Motor Cycles,
By Gardner D. Hiscox. **Price, $3.00**

Gas Engine Construction,
By Parsell & Weed. **Price, $2.50**

Liquid Air and the Liquefaction of Gases,
By Prof. T. O'Conor Sloane. **Price, $2.50**

Gas, Gasoline and Oil Engines,
By Gardner D. Hiscox. **Price, $2.50**

Complete Electrical Library (5 volumes),
By Prof. T. O'Conor Sloane. **Price, $5.00**

FREE A special circular of any of these books sent on request. Our 96 page catalog of scientific and practical books, sent free to any address in the world on request.

NORMAN W. HENLEY & CO.,
PUBLISHERS,
15 Beekman St. NEW YORK.

(*Continued from preceding page.*)

The Hercules Lamp Company intends to establish a factory to manufacture an acetylene lamp invented by Thomas Dunshee, McKeesport, Pa.

The Jones & Dyas Brick Company, Huntsville, Ala., will establish a $10,000 brick plant in Decatur, with a capacity of 20,000 bricks per day.

D. L. Moatz, of Hagerstown, Md., will erect at Round Hill, Va., a factory for making insulator brackets of locust for telegraph and telephone poles.

The contract has been let for the erection of a new factory building, 80x255 feet, three stories, for the Durant-Dort Carriage Company, in Flint, Mich.

A permit has been issued for a $15,000 factory for the F. H. Logeman Chair Manufacturing Company, 2018 to 2022 North Main street, St. Louis, Mo.

The Clarksburg (W. Va.) Co-operative Glass Workers Company has been organized and will manufacture window glass, bottles and their own supplies.

The Denver (Colo.) Paper Mills Company's plant is to be doubled. The company is now controlled by Pusey & Jones, officials of Wilmington, Del., and others.

The Essex Brass Foundry Company, Detroit, Mich., is putting up a two-story factory building, 45x100 feet, on Franklin street, near the foot of St. Aubin avenue.

C. J. Davis, Dr. E. E. Collins and M. E. Jones, of Columbia, Tenn., have formed a stock company and begun the erection of a flour and corn mill at Ashwood.

C. H. Carmichael is establishing a stoneware factory in Nacogdoches, Tex. Machinery has been bought. The manufacture of tile and sewer pipe is proposed later.

The hat factory of the John B. Stetson Company, Fourth street and Montgomery avenue, Philadelphia, Pa., will be increased by a seven-story extension, 46x200 feet.

A $1,000,000 packing house is proposed for Fort Worth, Tex., with Col. Geo. W. Simpson, president of the Fort Worth Stock Yards Company, prominent in promoting it.

The Philip Carey Manufacturing Company, asbestos mat, Lockland, O., will have erected a 75x150-foot zinc-lined acid-manufacturing building and make other improvements.

The Dauntless Burner & Gas Stove Company, Massillon, O., has increased its capital stock and will move to Akron, where it will build a plant to employ about 100 men.

The Union Foundry & Machine Company, Catasauqua, Pa., is having plans made for an addition to its works, in which will be placed special machinery and power equipment.

The Colwell Lead Company, New York, manufacturer of lead pipe and plumbers' supplies, will, it is understood, erect a plant at Elizabeth, N. J., to employ 1,000 hands.

J. P. O'Brien, of Peoria, Ill., one of the proprietors of a foundry and furnace building plant there, has been looking for a site on which to erect a plant in East St. Louis.

The Oneida (N. Y.) Community will erect a new silk mill at Kenwood, 180x48 feet. A building which it has used for this purpose in Sherill will be used for chain-making.

The Eastern Tube Company, in which Pittsburgh and New York capitalists are interested, is about letting contracts for an 800-ton-a-day tube and pipe plant at Zanesville, O.

The Alfred Bloom Company, Omaha, Neb., has been granted a building permit for a $6,000 factory, on Fifteenth and California streets, which is to be used as a planing mill.

The Genoa (O.) Manufacturing Company has been incorporated to carry forward the

(*Continued on next page.*)

Help Wanted—Continued.

Wanted—Experienced mechanical draftsmen. Apply, giving age, record, references and salary required, to Engineer Drafting Dept., General Electric Co., Schenectady, N. Y.

Wanted—A good machinist to take charge of about 10 men and build machine part of elevators by contract, or take small interest in business. Address Elevator Works, Council Bluffs, Ia.

Wanted—Two good toolmakers; one making tools for working on iron, the other on tools for brass; give references, experience and wages wanted. The Goulds Mfg. Co., Seneca Falls, N. Y.

Wanted—A first-class, up-to-date mechanical engineer who has energy, ingenuity and resource; all communications will be considered confidential. Address W. L. Ward, President Port Chester Bolt & Nut Co., Port Chester, N. Y.

We are enlarging our works, and will shortly require an increased number of skilled mechanics; we invite application from pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

General superintendent wanted for new valve shops in Canada; a first-class man, experienced in every department of work in iron and brass, will be treated liberally. Apply at once, National Iron Works, Ltd., 20 King st., East, Toronto, Canada.

Wanted—First-class machinists, vise hands, floor hands, machine hands; have lately increased our plant and can offer good men steady jobs and good pay; good, healthy town and cheap living. Write fully, American Mach. & Foundry Co., Hanover, York Co., Pa.

A first-c ass mechanic who is thoroughly acquainted with refrigerator and ice machines and has experience in putting up plants of the Plate ice system, wanted to go abroad; one who also speaks German preferred; state age, nationality, experience, references and salary expected. Address Box 207, AMER. MACH.

A good position is offered to a bright young man who is a fair stenographer and typewriter, and who understands bookkeeping and has had experience in machine shop manufacturing; one who understands keeping records and making up shop costs preferred. Apply, giving experience, age and references, to Box 253, AMERICAN MACHINIST.

Crane designer wanted, to go to England; must be particularly well up in the latest designs of electric cranes; all letters will be treated in strict confidence, and applications should give full particulars as to experience, age, names of former employers and salary desired; applicants must be fully capable of getting out complete designs and seeing their work through from beginning to end, but need not necessarily be able to design the motors; a good salary will be paid to a thoroughly competent and energetic man. C. L. Morris, P. O. Box 67, Cherry Hill, N. J.

AIR COMPRESSORS

Send for Complete Catalogue.

CLAYTON AIR COMPRESSOR WORKS,

26 Cortlandt Street, New York.

THE KELLY KIND

of Crank Shapers is the right kind. Extra strong where extra strength is needed; modern in every part. We make nothing but Crank Shapers, 15, 16 and 20 in.

Details and prices on request. . . . .

The R. A. Kelly Machine Co.,

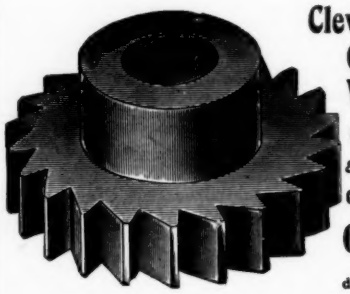
P. O. Box 488,

Xenia, O., U. S. A.

Lieber's Code used.

Wanted. *To purchase, or manufacture on a royalty, patented machine tools of new design or now on the market, for which there is a legitimate demand at a fair profit.*

Address Lock Box 21, Station B, Cleveland, O.



Cleveland Gear Works

W. R. SAWYER, Lessee.

86 Seneca St.,

Cleveland, Ohio.

GEARS

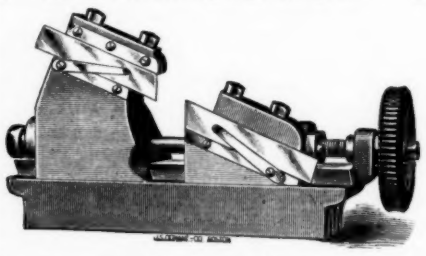
of all descriptions.

Cutting-Off Machines

Latest Improvements.

Standard Cone-driven and Accelerated Speed Styles

Inclined Tool Blocks giving shearing cut.



Patent receptacle for oil and chips

Patent Belt Shipper and other improvements.

Others have found it well worth while to send for the details of these advantages Probably it would pay you to do so.

Hurlbut-Rogers Machine Co.,

South Sudbury, Mass., U.S.A.

German Agents: Schuchardt & Schutte, Berlin and Vienna

English Agents: Chas Churchill & Co., Ltd., London and Birmingham.

1899

Bound Volumes.

A FEW MORE LEFT.

PRICE, $4.00. You Pay Express Charges.

American Machinist,

218 William St., NEW YORK.

A DAY'S WORK IN 3 HOURS is easily possible using the new electric wiring computator. Has four scales. Set number of amperes you want to wire for to number of volts lost, and over the fourth scale, in feet, find size of wire to use. Works from ⅛ to 12 volts lost, from 4 to 100 amperes, and all sizes wire 20 to 0000, 2 to 300 feet. Twelve in. long, substantially made, 75c. post-paid. May be returned if not satisfactory. **ARTHUR E. COLGATE, P. O. Box 2224, New York City.**